

POPULAR MECHANICS

MAGAZINE

SO YOU CAN UNDERSTAND IT

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In This Issue

Rear Admiral Charles B. Momsen writes on
SUBMARINE WARFARE



HOW TO AIR CONDITION YOUR HOME

Hottest Truck on the Road
— the TURBO-JET

What Owners Say
ABOUT THE PACKARD

Exciting new 1953 Studebaker receives Fashion Academy Award!

Gold medal for outstanding design and distinctive styling presented to the new American car with the European look



AMERICA'S most strikingly original car now proudly carries a new distinction.

The Fashion Academy, noted New York school of fashion design, has presented its Gold Medal for outstanding style to Studebaker.

Arrange to drive this excitingly different new Studebaker — this dramatically low, su-

perbly balanced new car that officially proved itself a top gas mileage star in this year's Mobilgas Economy Run.

Find out what a brilliant performer the 1953 Studebaker is—what road-hugging stability it has. Nine body styles to choose from—and all down to earth in price. Stop in at a Studebaker dealer's.



Commander V-8 Regal Starlight coupe for five. Chrome wheel discs, white sidewalls—and glare-reducing tinted glass—optional at extra cost.

Don't get caught with your **Battery down**



Battery troubles aren't seasonal. Warm weather can sap a battery's strength as much and more than winter driving. So take heed. Stop in at your Goodyear dealer's today — have your battery checked free with the portable, accurate, Goodyear All-Purpose Tester. It's the ONLY way to spot battery troubles before they start. While there—ask about the Goodyear Dry Proof Double Eagle Batteries, too.

Goodyear, Battery Department, Akron 16, Ohio



Double Eagle—T. M. The Goodyear
Tire & Rubber Company, Akron, Ohio

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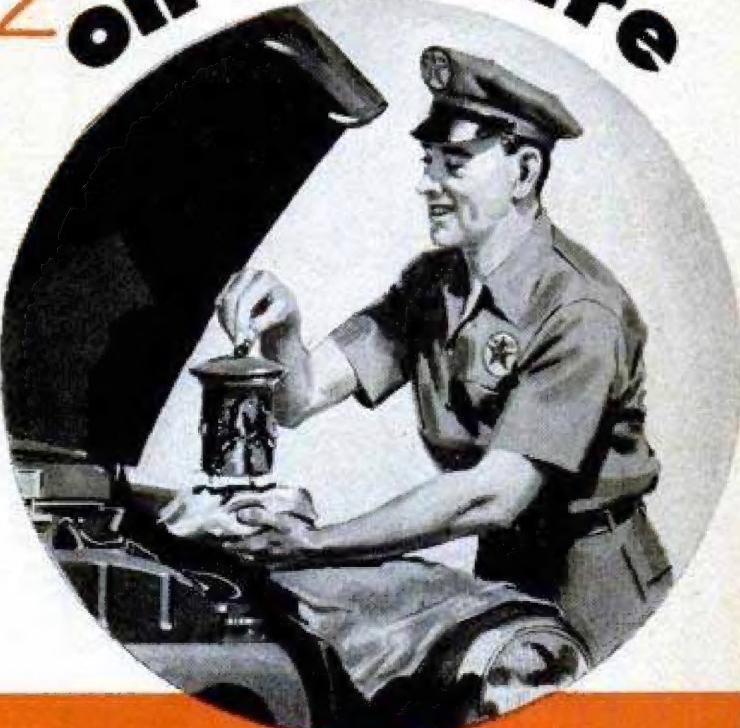


Texaco Tips

How oil filter inspections save you money

If your car's oil filter is clogged, it can't filter out dirt and other abrasives that occur in normal engine operation. And that can mean trouble and expense for you! To keep your oil filter functioning properly, see your Texaco Dealer for an oil filter check-up. He will inspect it — and replace it, or the filter cartridge if necessary. This assures a constant flow of cleaner oil to your engine's moving parts. Care like this can help you enjoy more miles of trouble-free motoring.

on car care



How to get that "cushiony" ride

Even when Marfak is hit with a hammer, it stays put. Ordinary grease would splatter. This shows why Marfak gives your car better chassis protection. It's extra tough and stretchy . . . clings far longer to points of friction and wear. And even when the going gets rough, Marfak resists jar-out and squeeze-out — wash-out, too. All this adds up to smooth, cushiony riding for you — for 1,000 miles or more! Drive in for longer lasting Marfak lubrication today. See your Texaco Dealer, the best friend your car ever had.

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H. H. WINDSOR, Founder

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this month's cover

SECRET long-range sonar gear fills the strange bow of this submarine. The sub, with its sensitive new "ear", is designed for one purpose—to find and destroy other submarines. Eventually, says Rear Adm. Charles B. Momsen, "submarines will be pitted against submarines in grim undersea battles, each casualty being marked by an enormous underwater explosion, then silence." Admiral Momsen speaks with authority, for he is one of this country's most illustrious submariners. On page 74 he asks the question "Will the New Submarine Rule the Seas?" and answers it with little-known information on the latest undersea craft, and some fascinating proposals for the future. A nuclear power plant, he suggests, may not be the ultimate engine, and the screw propeller may be supplanted by radically new methods of propulsion. You'll glimpse some novel peacetime as well as wartime uses of the submarine in this informative article

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For the Craftsman

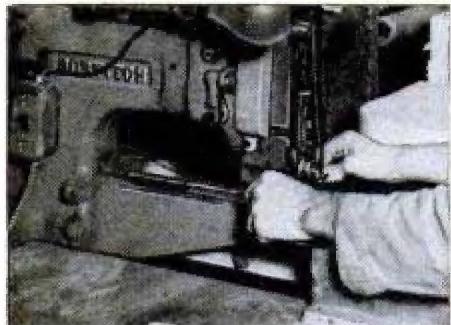
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Other items, and manufacturers of available products described, are listed on pages 12, 14 and 16

HOW BOSTITCH MAKES THESE JOBS EASY



Tacking upholstery to chair seat, Bostitch T5AD Air Driven Tacker lets operator do it with one hand. Just squeeze, and Bostitch Tacker shoots staple into work. Drives staples almost as fast as operator can guide tacker . . . four times faster than hammer and tacks. Does the job faster and with less effort. Eliminates mashed fingers, damaged work, sore mouth from holding tacks.



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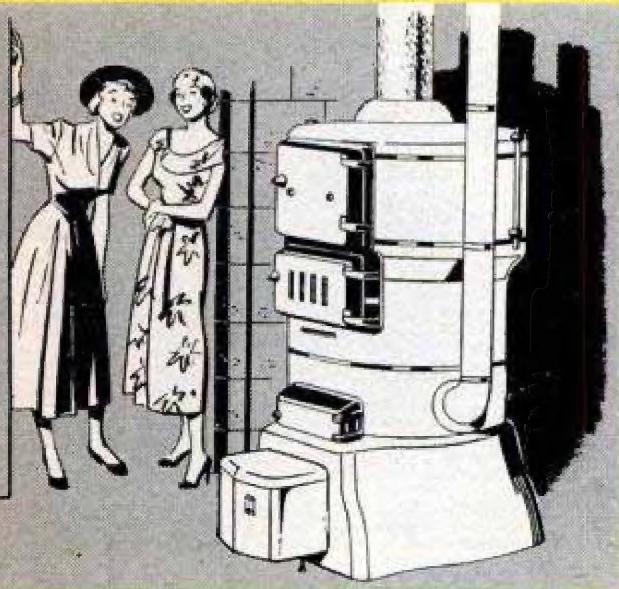
HEAT

Why suffer through another winter of old-fashioned heating? It's so easy to install a Timken Silent Automatic Conversion Burner now and give your heating plant—and yourself—a new lease on life!

You'll do better in every way with a Timken Silent Automatic! These thrifty burners save real money on fuel. They're clean-burning and dependable, engineered to outlast your present heating plant. Beautifully and compactly designed, they keep your basement looking neater—often give you enough extra space to build that workbench or fix up that play room. And you'll find work-free Timken Silent Automatic Heat gives you plenty of extra time to spend in your new-found space!

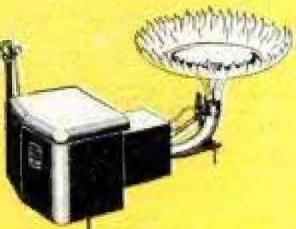
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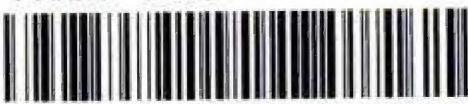
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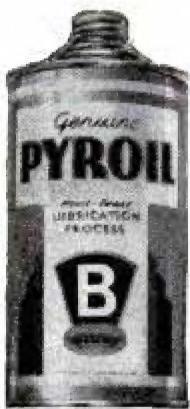
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in this corner..... THE EDITORS



"The Thinker"?

Deep thinker? Well, no—but he has plenty of time for it. This man has a lonely job in one of the loneliest spots in the world—Kodiak Island. He is counting salmon. This monotonous assignment is one



part of an important project of the U. S. Fish and Wildlife Service aimed at bringing back the red salmon in the Alaska area. The story of this undertaking, vital and interesting to anyone who loves fish and fishing, will appear in the September issue.

To the Editor:

Your Popular Mechanics Auto Racing Annual is truly a great job. It should make life considerably easier for me since I get hundreds of letters from young fellows about a great many things which are covered in your book. My suggestion to them now will be that they purchase your Auto Racing Annual for the answers to their many, many questions.

Congratulations on a swell job.

Wilbur Shaw, President,
Indianapolis Motor
Speedway Corporation.

To the Editor:

We noted with great pleasure the description of the stationary diesel engine, built by us, in the April issue of Popular Mechanics Magazine.

We would, in this connection, advise you that not alone is it one of the largest diesel engines in the world, but also the largest

(Continued to page 8)



How these 18 Experts can help you

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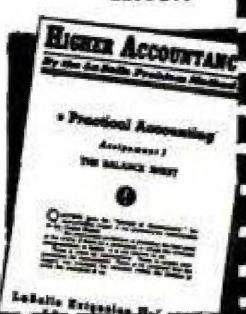
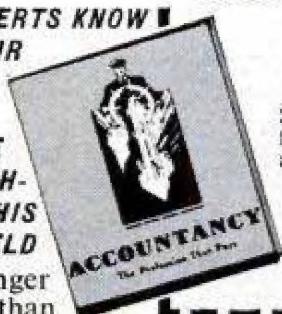
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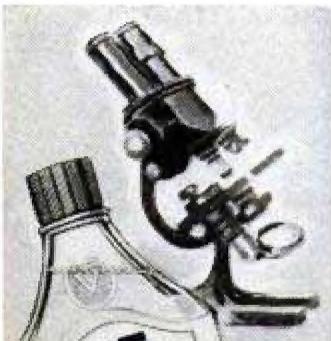
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(Continued from page 6)

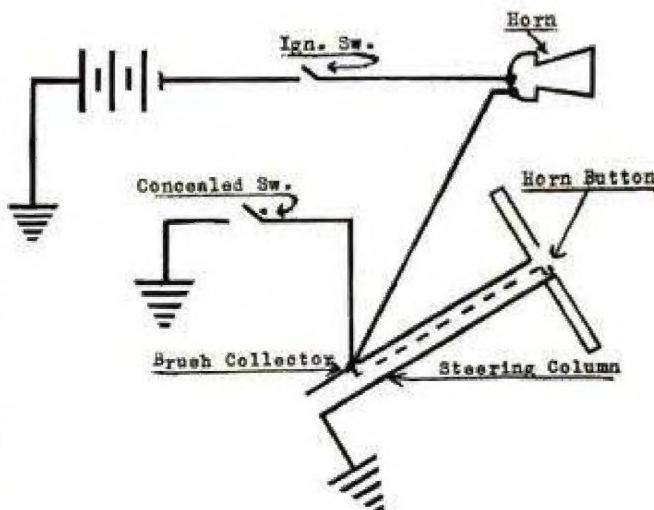
stationary diesel engine in the world, built by us 20 years ago.

Burmeister & Wain's,
Copenhagen, Denmark.

To the Editor:

I was reading the article in the April issue of *Popular Mechanics* on how to prevent theft of your automobile and thought you might be interested in how I wired up our Jeeps over in Korea to prevent theft.

The first thing I had to do was put the "hot" wire going to the horn onto the dead side of the ignition switch. Then, run a



wire from the steering-column collector brush through a switch concealed under the dash to ground. When a person would leave the Jeep, he would close the switch under the dash. Then, if a thief turned on the ignition switch it would close the circuit and blow the horn.

Alex Crozier,
Woodhaven 21, Long Island, N. Y.

To the Editor:

EDITOR'S NOTE: Known to every tourist along the Columbia River highway is Celilo Falls, picturesque and beautiful spot where the Indians held exclusive fishing rights. These rights became a subject of U. S. Senate discussion recently when Yakima Indians appeared to protest construction of a dam which will wipe out fishing there. Some time ago, the government instituted a project to restore historical Celilo Falls Indian village and we asked contributor Tom Riley of Portland, Ore. (builder of PM's ranch house) to report on the status of the project. Here is his report:

You will get a kick out of what has happened, so I will relate the phone conversation in full:

Riley to somebody in the Portland Indian Bureau: "...about this Celilo Falls Indian village?"

(Continued to page 10)

How I foxxed the Navy

by Arthur Godfrey

The Navy almost scuttled me. I shudder to think of it. My crazy career could have ended right there. Who knows, I might still be bumming Chesterfields instead of selling them.

To be scuttled by the Navy you've either got to do something wrong or neglect to do something right. They've got you both ways. For my part, I neglected to finish high school.

Ordinarily, a man can get along without a high school diploma. Plenty of men have. But not in the Navy. At least not in the U. S. Navy Materiel School at Bellevue, D. C., back in 1929. In those days a bluejacket had to have a mind like Einstein's. And I didn't.

"Godfrey," said the lieutenant a few days after I'd checked in, "either you learn mathematics and learn it *fast* or out you go. I'll give you six weeks." This, I figured, was it. For a guy who had to take off his shoes to count



above ten, it was an impossible assignment.

I was ready to turn in my bell-bottoms. But an ad in a magazine stopped me. Here, it said, is your chance to get special training in almost any subject—mathematics included. I hopped on it. Within a week I was enrolled with the International Correspondence Schools studying algebra, geometry and trig for all I was worth.

Came week-end liberty, I studied. Came a holiday, I studied. Came the end of the six weeks, I was top man in the class. Within six weeks I had mastered two years of high school math, thanks to the training I'd gotten.

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(Continued from page 8)

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Riley to Mr. —: "... about this Celilo Falls encampment being flooded . . ."

"No," growls Mr. —. "Of course, the encampment will not be flooded! Who said that? We planned for such when we built it."

"Well," asks Riley, "what about the falls and the fishing grounds?"

"Yes, the falls will be flooded and, obviously, the fishing grounds will then be gone. But that isn't by any means as important as the benefits that will be given by the Dalles Dam."

"Well, what will the Indians use the encampment for if there is no more fishing?"

"We are not quite sure about that point," states Mr. —.

To the Editor:

When a gale swept over the Orkney Islands, north of Scotland, it reached hurricane speeds of 125 miles per hour. This gale



is responsible for the freak structure shown in the photo. The air pressure on the telegraph pole was so great that the center section was torn out, leaving the top of the pole with insulators and crossbars hanging from the wires.

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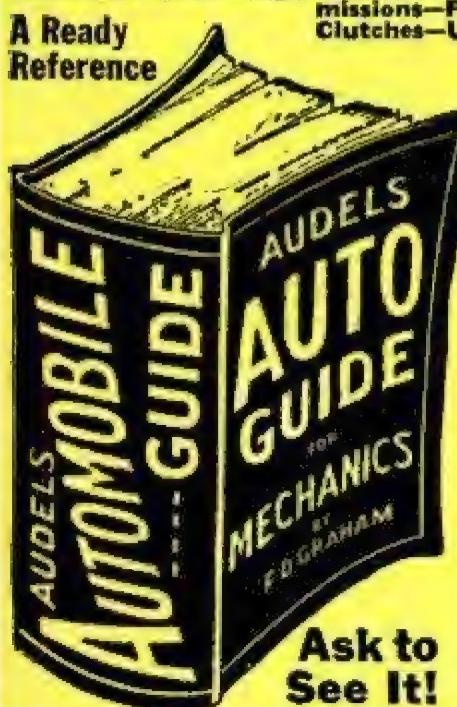
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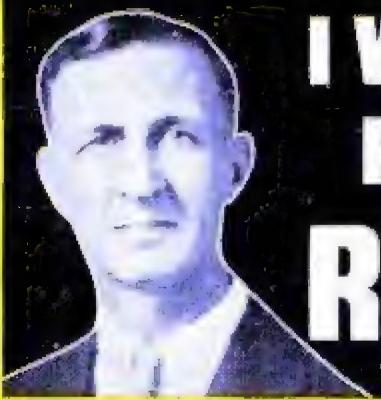
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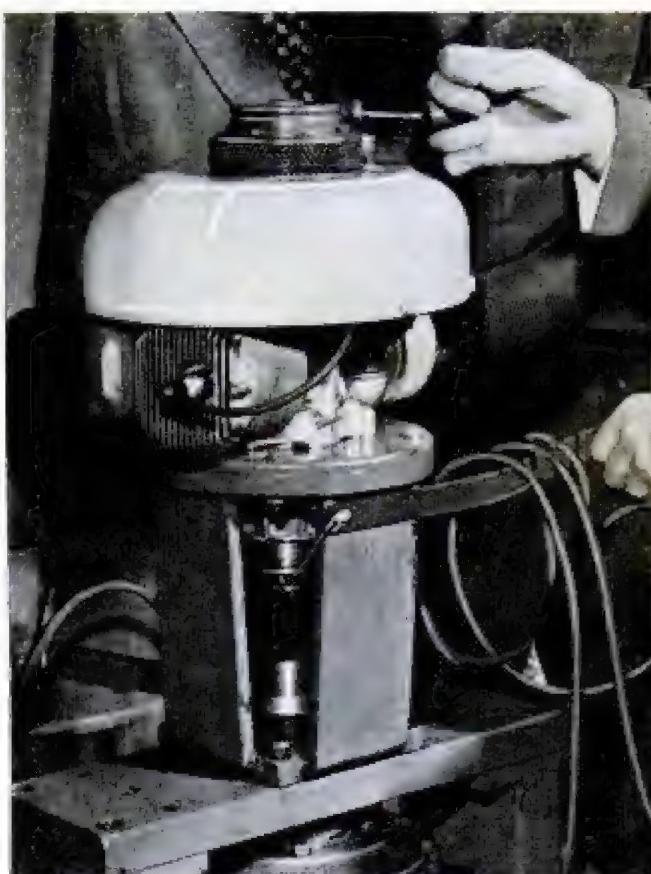
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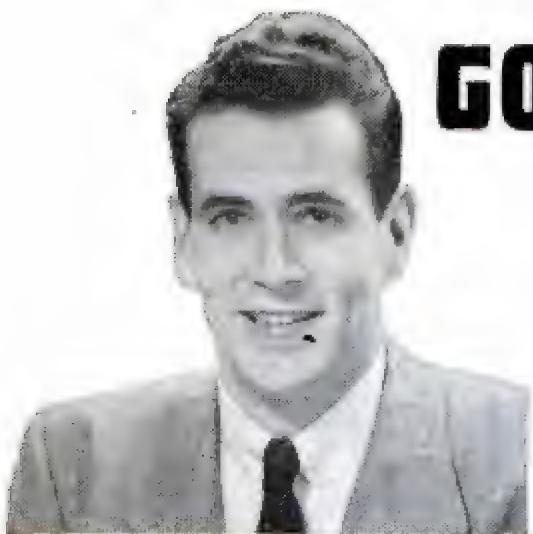
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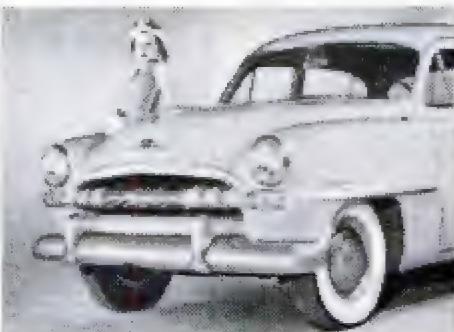
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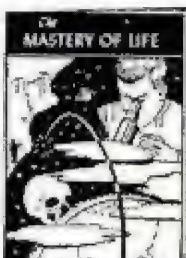


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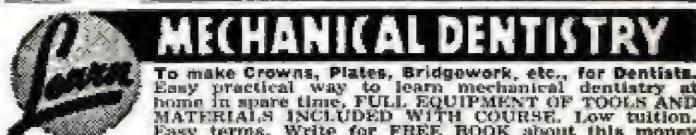
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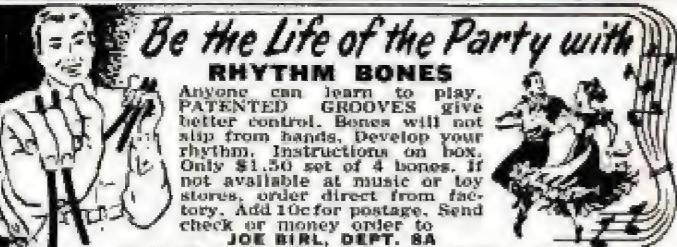


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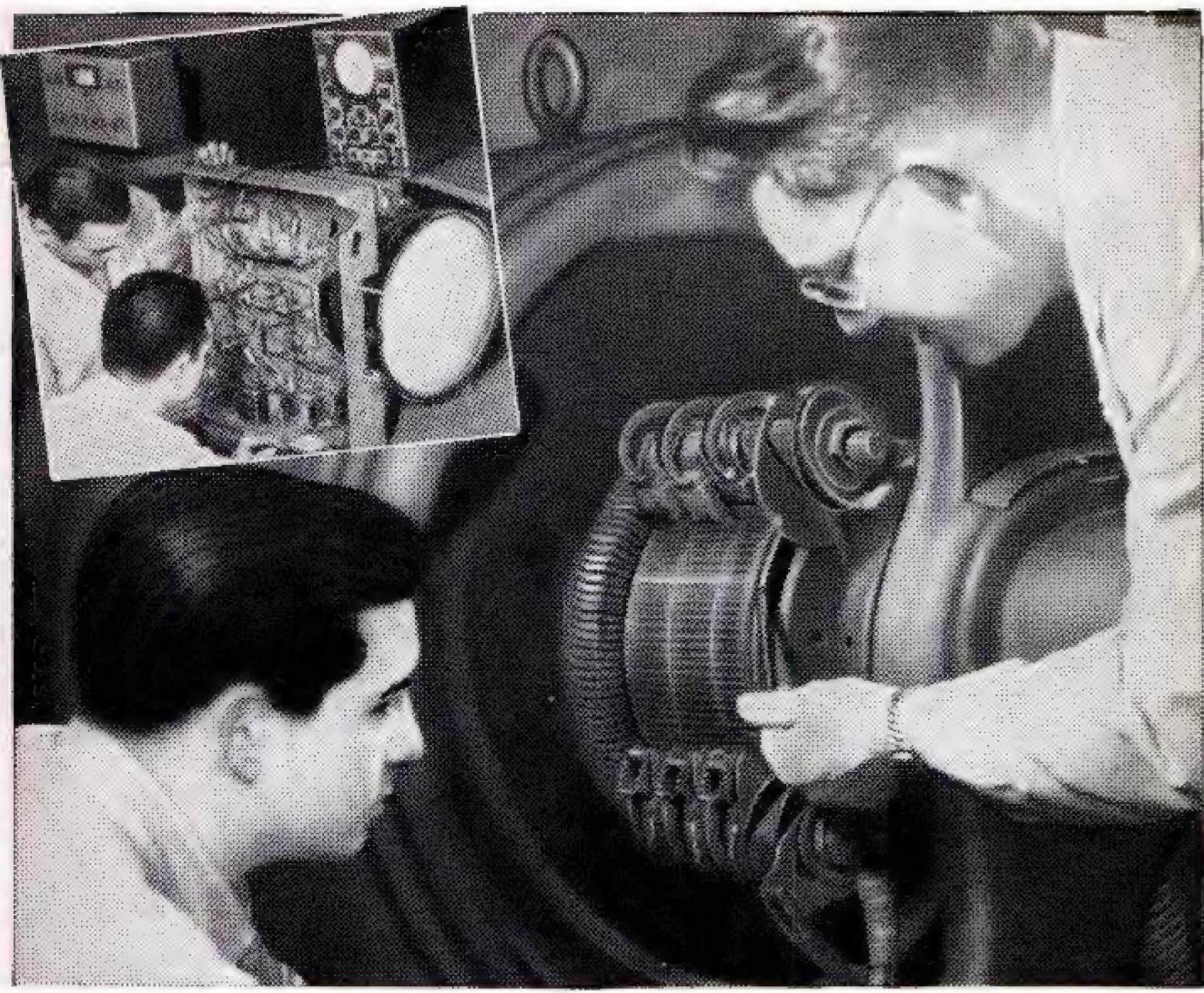
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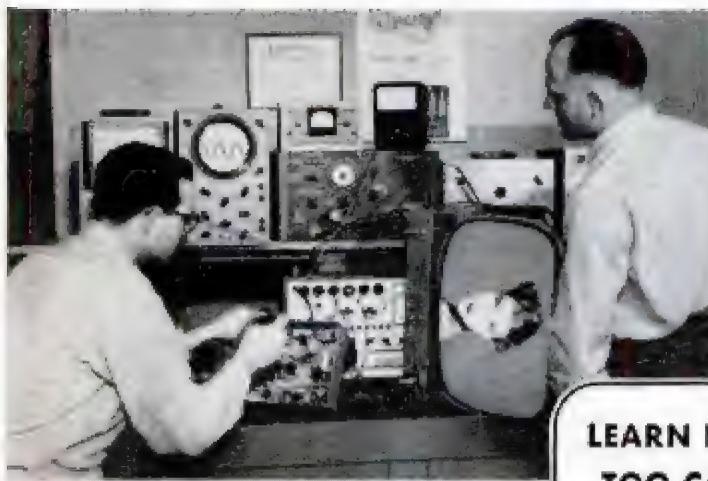
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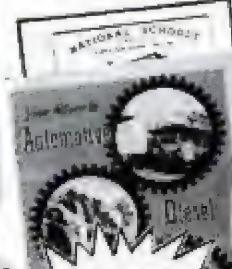
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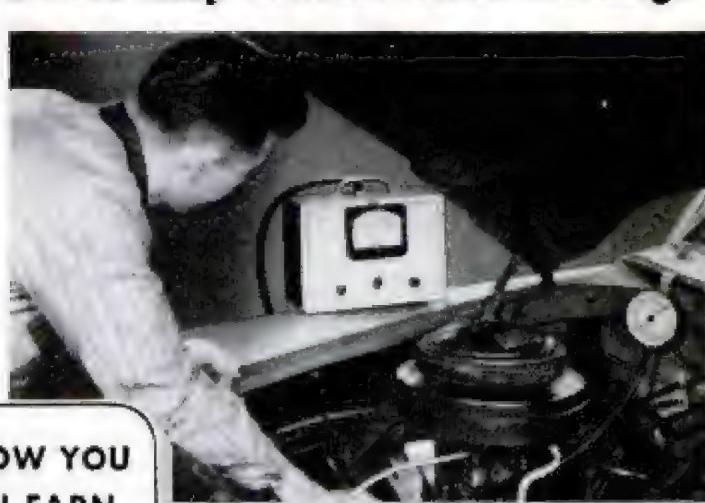
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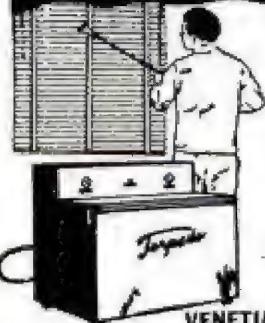
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By F. S. Strong



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I won't make any fancy promises of \$50.00 a day. And I'm not after any of your money. What I can do is show you a simple plan by which you can pick up enough extra money every week to help make up for the money you're losing in higher taxes and higher costs of living. And I supply your working outfit free—no charge and no deposit. Just your name is all I need. Read my proposition. It is honest and down to earth. And it won't cost you anything to try it.

TODAY almost everyone needs extra money. Increased taxes and increased living costs are making your dollar worth less and less, so you have to have more and more dollars just to keep even. There are lots of good ways to make extra money. I don't say my way is the best. I do say it's one of the easiest and most pleasant. It even leads to making new friends. It doesn't call for house-to-house canvassing, either. Let me explain:

I am Sales Manager for a very big manufacturing company. We make Stainless Steel Cooking Utensils. We do an enormous business with hotels, restaurants, hospitals, and institutions. We also make utensils for the Army, Navy and Air Force.

As a result, we have very low manufacturing costs. We can sell a set of Stainless Steel Cookware for home use for about what it costs some companies to make it! In fact, for years we did sell to one Sales Organization who resold our cookware house to house under their own name. They got \$120.00 for the same set that our people sell for approximately half of that.

You've probably heard of salesmen who give dinner parties in homes and then take orders from the ladies who attend. These salesmen have to get a high price because it costs money to give parties—he has to make his share—and his supervisor has to make his. The sales organization adds a profit and the manufacturer has to make his. So there are about four or five profits added to the actual manufacturing cost.

About two years ago I got to figuring. There are five good reasons why Stainless Steel is the kind of cookware that should be in every home. 1. It washes as easy as a drinking glass. No scouring, scraping or scrubbing. 2. It doesn't rust or corrode—and it doesn't stain. 3. It doesn't affect the taste of food. 4. Carlton Ware enables you to prepare food by the method called "waterless cooking" which keeps more of the natural minerals and vitamins in your food and makes the food taste better. 5. Buy it once and you're all through buying for life. You can't wear it out.

You see, Stainless Steel is not a coated or plated metal, like chromium plate on the bumper of your car. That chromium plate can chip or wear off and exposes the raw steel underneath. Then the steel rusts. But our kind of Stainless Steel is stainless all the way through. It can't chip, crack, peel, or wear off. You could use a set the rest of your lifetime and then give it to your children and it would still be good for their children.

Well, I figured that if the price was low enough every family could afford Stainless Steel Carlton Ware. So I worked out this plan! We would sell a complete set of 15 pieces at a figure that would include our profit. Then you add your profit and re-sell this set to your friends and neighbors for just about half of the usual price charged on the "party plan." They are glad to get such a bargain and they feel that you've done them a real favor.

The plan becomes like an endless chain. When a woman gets her first piece of Carlton Ware she gets so thrilled with its better cooking and easy cleaning that she talks and talks. She can't wait to demonstrate it to her friends and tell them all about it. She's so proud of its silvery sheen that she just "bubbles over." So just by letting your own friends in on a good thing, before you know it their friends call you up and ask

if you can get the same low prices for them. Then their friends call you and their friends' friends. It goes on and on!

To make an extra \$125.00 a month, you only have to deliver seven sets and that's easy. Mrs. Montell in Pennsylvania took orders for \$1400.00 worth in her first month. And Mrs. William Blanchow wrote, "Got my set Saturday—I already have 17 customers."

Now, I'll let you in on another part of my plan. If you take only ten set orders a month for six months my company pays your expenses for a winter vacation in Florida. We maintain a beautiful resort in the Florida Keys just so our sales representatives can enjoy a Florida vacation at company expense.

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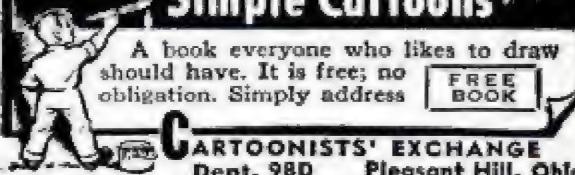
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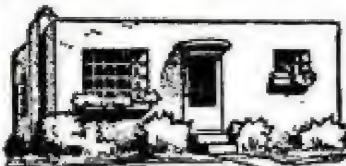
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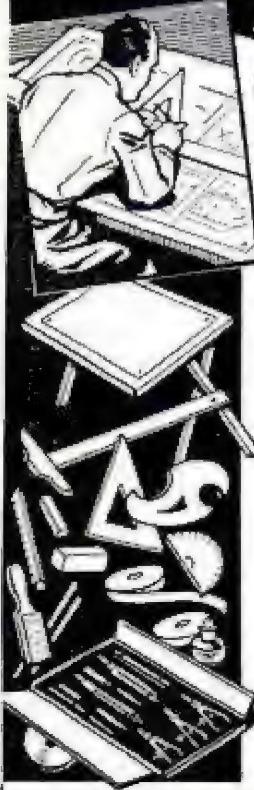
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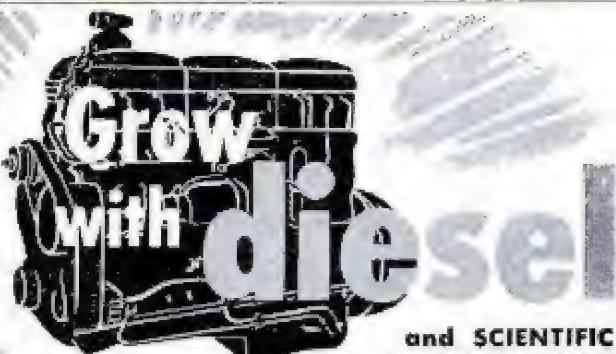
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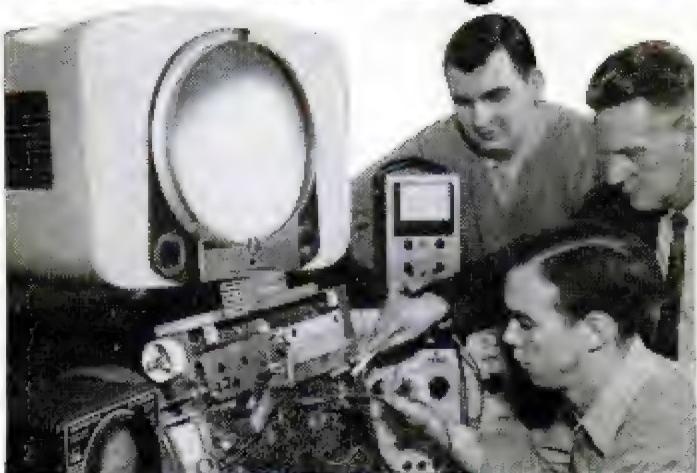
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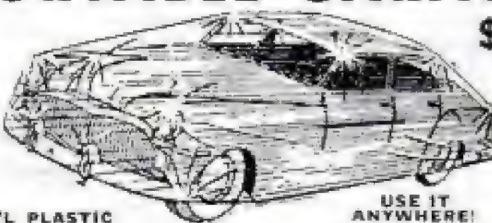
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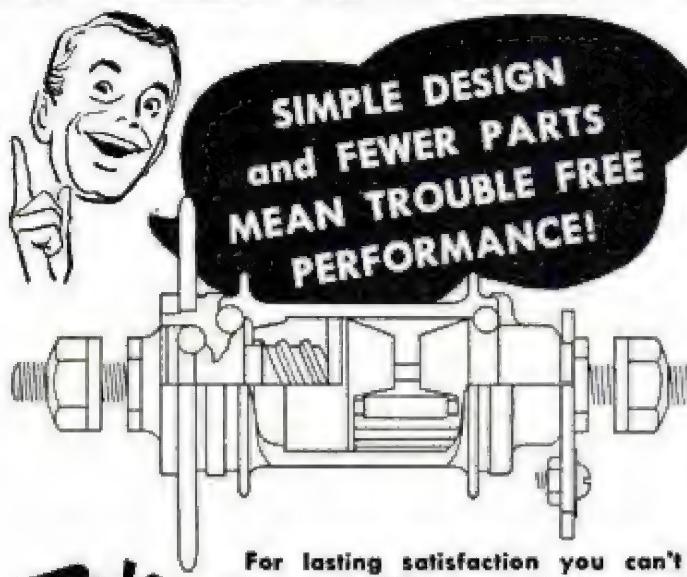
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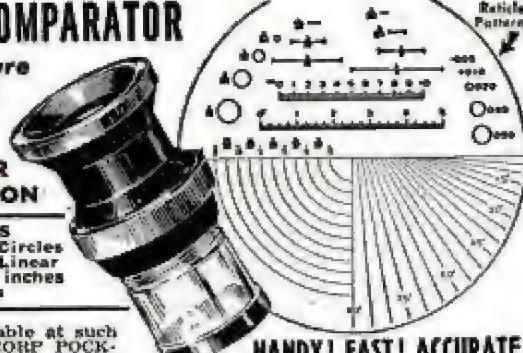
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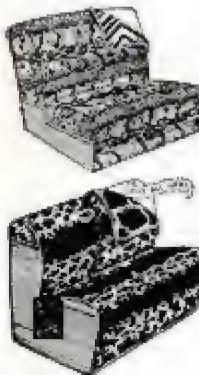
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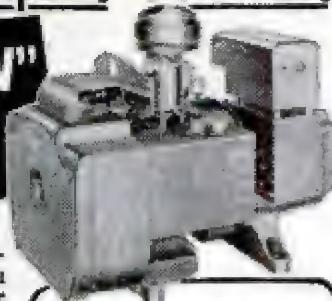
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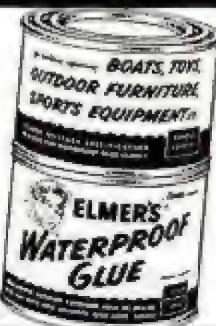
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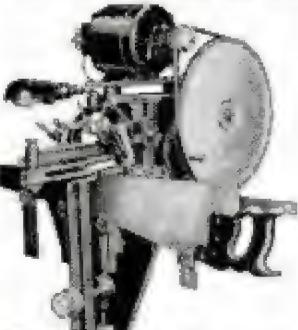
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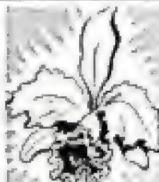
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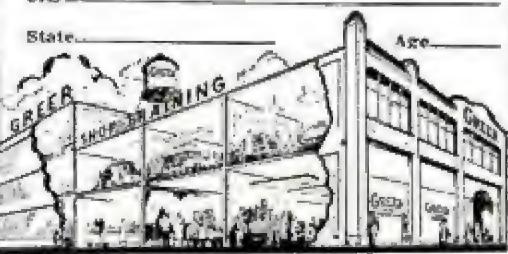
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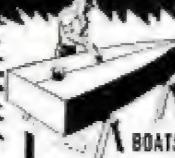


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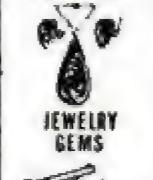
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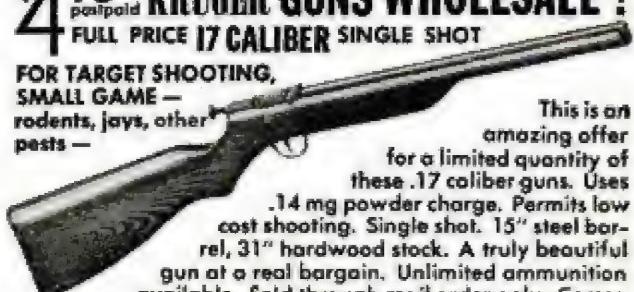
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"HOW To Sell by Mail." over 14,000 word book for only 25c. Let your friendly mailmen be your silent salesmen. A.N.M. Sales Promotion Co., 356P LaSalle, Buffalo 15, N. Y.

START A buying service, buy wholesale thousands nationally advertised products. Make big profits selling at sizable discounts. Postcard brings details. American Buyers, 630-R Linden, Buffalo, N. Y.

START A profitable subscription business in spare time! We need men and women (young or old) as representatives for all leading national magazines. Liberal commissions paid for new and renewal subscriptions. Start earning money in this pleasant work at once! Clip this ad and send with your name and address to: International Circulation Distributors, Dept. PM, Hearst Magazines, 250 W. 55th St., New York 19, N. Y.

ASTOUNDING Profits raising jumbo frogs. Free pamphlet. Brolo Frog Farm, West Frankfort, Ill.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 1, Wisconsin.

NOTARY Public commands more money. Be one. Stationers, Helotes, Texas.

\$10,000 PROFITS! Your own mailorder business! No capital risk! Success plan (worth \$2) free! Write today! Treasury, 709 Webster, New Rochelle PM-14, New York.

BE Independent, be secure, have your own profitable business—Earn \$20.00 and more a day making beautiful, fast-selling lamps at home. No equipment needed. Illustrated course teaches you quickly. Course, parts catalog, wholesale price list—only \$2. Gearon Co., Dept. 200-E8, 27 S. Desplaines, Chicago 6, Ill.

MONEY Found. Be our agent in your community. Top quality watches, diamonds, jewelry, etc., at wholesale prices. Amazing profits. No age limit. Experience unnecessary. Send for free catalog. Zerah Brothers, 602 Mission Street, Dept. 81, San Francisco 3, Calif.

SPECIAL Factory prices mean more profits. Costume and religious jewelry. Free price lists. Customcraft Jewelry Manufacturing Company, 26 Customhouse Street, Providence 3, Rhode Island.

SCHOOL Seniors—Sell classmates America's most beautiful graduation name cards. Largest selection. Highest commission. Outsell all others. Free sample kit. Printcraft, Dept. M, 1509 Maple Street, Scranton 5, Penna.

SENSATIONAL Home plastic business. Men and women make big money. Spare or full time. Also valuable liquid marble information. Free catalog. Write: Bing Products, PM-553B, Watertown 12, Mass.

FOUR Ways to increase your income at home. Free details. Dixie Mailers, King, N. C.

OPERATE Profitable mailorder business using free advertising method. Revealing information free. H. P. Seidel, 7070 Hollywood Blvd., Hollywood 28, California.

AFRICAN Exports. Save 50%. Leather goods, perfume, jewelry. Write Brown, Boite Postale 2054, Casablanca, Morocco.

"**MONEY-Making for the Millions.**" New, exclusive publication reveals how you or anyone; young, old; man, woman; anywhere; can make more money, gain financial security. Eye-opening details free. Write Merit Mail Order, Montrose 1, Mo.

EARN \$2,600 A year working hour a day at home! Free booklet. A. O. Co., 441 N. Seneca, Wichita 12, Kansas.

PRIZE Contests! Fabulous career for thousands! Stamp proves it! National Contest Bulletin, Box 2585-P, Miami 16, Florida.

MONEymaking Deluxe opportunity packet. Only 10c. Don Supkow, Blackwood, N. J.

MONEymaking Opportunities, homework. Free literature. Wiese, 1516 Franklin, Waterloo, Iowa.

MAIL Catalogs featuring real merchandise from your home. Everything furnished. Rush 25c for sample, details. Starr, Box 188, Truro, Nova Scotia.

LIFETIME Repeat mailorders! Starting supplies \$1.00. Denison Enterprises, 760 Hippodrome-A, Cleveland 15, Ohio.

WIN Contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609½ East 5th, Duluth, Minnesota.

TIE-Breaker picture puzzles exposed. \$5.00. Wenograd, Box 1495, Philadelphia 5, Penna.

SELL Titania gems; \$9.75 carat wholesale. More brilliant than diamonds. Free catalogue. Diamondite, 1404-M Mitchell, Oakland 1, California.

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INSTALL Hand railings on stairs, terraces, porches. Unlimited applications. Provides safety. Cast aluminum universal joints lock with set screws. 1½ inch aluminum tubing will not rust. Easy to assemble. Fits any angle or grade. Install in wood, stone, ground or concrete. Profitable. Send for folder. Kloppenborg Aluminum Foundry, Dept. PMC-3, Davenport, Iowa.

PUBLISH Your own magazine. Handsome 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits. 25c brings sample, details. National, Ord. Nebr.

137 PLANS To make money, local mail-order. Details: Elite Co., 220 Grand St., New York 13.

READ Progressive Mailtrade, the magazine that tells how to make money by mail. Dime brings sample and special offer. Progressive Mailtrade, Box 357, Sheboygan, Wisconsin.

FREE Book "505 Odd, Successful Businesses." Work home. Expect something odd! Pacific, Oceanside, Calif.

SPARETIME Profits taking subscriptions, all magazines. Wholesale catalog free. Cassell Agency, Westfield 2, New Jersey.

\$5.00 PER HOUR assembling driftwood lamps. Sam Patchett, 2187 N.W. 24 Court, Miami, Florida.

ASSEMBLE Electric fans. Exhaust and circulating for home, attic, kitchens, restaurants, offices, factories. Sells easily. We furnish all fan parts including electric motors. Send for wholesale parts catalog. Kloppenborg Aluminum Foundry, Dept. PMC-3, Davenport, Iowa.

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CEYLON Curios, gems. American testimonials. Unique opportunity. John Rajapakse, Negombo, Ceylon.

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PRODUCT Analysis, manufacturing formulas, processes developed. Moderate fees. Plastics, Box 1574, Boston 4, Mass.

MILLER'S Modern manufacturing formulas make fast-selling products that get the business and pay. Fifty years supplying the best. Late literature free! Miller. Consulting Chemist, Tampa, Florida.

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FREE Formula catalog. Anything analyzed \$35. Western Chemical, Salem, Ore.

ANY Formula \$3.00. Chemical Instruction Sheet—catalog 10c. J. Belfort, 216 W. Jackson, Chicago 6.

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PLEXIGLAS Sheets—Cut to size. Clear. All thicknesses. Standard outdoor translucent colors. McClarlin Plastics, P.O. Box 168, Hanover, Penna.

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PLASTICS Home-craft course for men and women. Tells and shows how to make hundreds of fast selling plastics products. All plastics and materials for 23 projects included in course. No special tools needed. Course pays for itself. Write for free booklet. Interstate Training Service, Dept. D3H, Portland 13, Oregon.

NEW Liquid casting plastic. Clear, colors. Embossed flowers, insects, coins. Saw, drill, carve. Send 25c for Castolite Creations Manual and proved success plan showing how to make money at home. Castolite, Dept. J-101, Woodstock, Ill.

INTERNAL Carving of Plastic's manual, catalog, beautiful finished carved brooch, complete \$2.00 postpaid. Plastic's, Box 1812, Salt Lake City, Utah.

LUCITE. Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost, 1/16", \$1.20; 1/8", \$1.40; 3/16", \$1.75; 1/4", \$2.00. Include 10% postage. Almac Plastics, 600 Broadway, New York City.

PLASTIC, Sheets, rods, tubes, etc. Free list. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

PLASTIC—Lucite, Plexiglas, Acetate, Vinylite, Polyester-Fiberglas. Low, low prices. Value-packed, bargain-filled catalog 10c. Airmailed 25c. Gem-O-Lite, Box 6884P, North Hollywood, California.

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AMAZING New book of science. Experiments, formulas and catalogue of laboratory supplies. Only 25c. National Scientific Co., Dept. 18, 2204 W. North Ave., Chicago 47, Illinois.

IMPROVED Second printing, spectacular chemical fireworks experiments manual. Not mimeographed sheets. Contains complete formulas, set-ups, data, on thermits, fulminates, explosive powders, etc. Still \$1.00 postpaid. Chemi-Techne Laboratories, 561CE Riley, Buffalo 8, N. Y.

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AGENTS WANTED

MEXICAN Feather pictures. Sell on sight; 200% profit! Free details. Sample 20c stamps (no coins). SylviaP, Apartado 9036, Mexico City.

AMAZING Opportunity! Earn \$8,000-\$12,000 annually! Wanted! Top-flight salesmen who sell to dealers in small towns of 10,000 or less. No investment. No merchandise to buy. Automatic repeat sales. Complete line of big demand items, perfect for needs of small town merchants. 350 page catalog now on presses, available soon. Choice territories still open. Write today! Dept. PM-100, 2950 W. Grand Ave., Chicago 22, Ill.

RUN A spare-time greeting card and gift shop at home. Show friends samples of our new 1953 Christmas and all-occasion greeting cards. Take their orders and earn up to 100% profit. No experience necessary. Costs nothing to try. Write today for samples on approval. Regal Greetings, Dept. 61, Ferndale, Michigan.

MAKE Money introducing world's cutest children's dresses. Big selection adorable styles. Low prices. Complete display free. Rush name. Harford, Dept. K-2341, Cincinnati 25, Ohio.

QUICK, Easy sales, big profits introducing amazing new invention that banishes clothespins forever, cuts clothes hanging time in half. Lifetime guarantee. Write for free facts, sample offer. Zip-Grip, Dept. C-109, 3751 Harlem Road, Buffalo 15, N. Y.

NEW Plastic mending tape. Just press on! Repairs clothing instantly. Lightning seller. Samples sent on trial. Kristee, 178, Akron, Ohio.

EXTRA Money for you, your club or church. Up to 100% profit selling new Christmas, all-occasion greeting card assortments to friends, others. Leading 21 card \$1.00 boxes, religious and novel cards, gift wrappings, ribbons, stationery, animated books, unusual gift items. Deluxe imprinted personal Christmas cards. Experience unnecessary. Write for samples on approval, special offers, extra 5% bonus plan. Hedenkamp, 361 Broadway, Dept. PM-29, New York.

AGENTS, Salesmen, distributors make \$250.00 weekly. Sell sensational new Kill-Glare for auto windshields. Gives car 1953 look. No more glare from sun, headlights, etc. One minute demonstration. Priced right. Big profits. Send \$1.25 for sample. Refundable first order. (Retail \$1.50.) Kill-Glare, 2619P Division, Chicago.

AMAZING Money making offer—\$50 or more selling 100 boxes America's leading Christmas cards. Samples on approval. Complete line. Free samples personal Christmas cards and stationery. Sensational bonus. Write, Lorain Art Studios, Dept. 113, Vermilion, Ohio.

\$200 WEEKLY. New invention. Amazing 4-second Presto emergency tire chains fit all modern auto wheels. National advertising building big demand. 3 sales daily to oil stations, dealers, etc., make \$200 or more weekly. Territory going fast. Write Presto Chain Co., Dept. P-24, Des Moines 2, Iowa.

EASY Money! Sell new kind nylons. Guaranteed 3 months. Perfect fit, like made-to-order, for every leg-shape. Sample kit with actual stocking free. American Mills, Dept. 420, Indianapolis.

116 DIFFERENT Ways to make extra money! Sell Christmas, all occasion greeting cards. Big profits. New bonus reward. Experience unnecessary. Write for feature samples on approval, free samples name imprinted Christmas cards, exclusive stationery, free color illustrated catalog, selling guide. New England Art Publishers, North Abington 833-D, Mass.

AT LAST! Something new and sensational in Christmas cards. Make extra money fast! Show satins, velours, metallics. Gets easy orders. Pays up to 100% cash profit. 30 free samples. With name 50 for \$1.50. Big line. Amazing new Glo-in-the-Dark ornaments, personalized matches, stationery. Several \$1.00 boxes on approval. Euro Greetings, 2801 Locust, Dept. 340-K, St. Louis, Mo.

JUST OUT! New thrilling sensation in Christmas cards. Make big money! Show luster foils, satins, brilliants. Amazing values bring easy orders! Magic Glo-in-the-Dark ornaments, personalized stationery, matches. 30 free samples. With name 50 for \$1.50. Several \$1.00 boxes on approval. Joy Greetings, 507 N. Cardinal, Dept. 60-L, St. Louis, Mo.

TELE-Pep. TV unit. Sensation. Sample \$2.00. Or, write quick. Smith Agency-VPM, Excelsior Springs, Mo.

HANDMADE Purses, belts, other typical items from Guatemala. Free catalog. Use airmail. Maplon, Box 268, Guatemala, C. A.

BUY Wholesale thousands nationally advertised products at big discount. Free wholesale plan. American Buyers, 629-R Linden, Buffalo, N. Y.

AMAZING Profits selling exclusive Sunshine Christmas cards. Nature prints, scripture text, imprints, nationally famous. 21 for \$1.00 assortments all sell on sight! Many others! Also gift wraps, stationery, etc. Send for samples on approval. Sunshine Art Studios, Inc., Dept. PM-8, Springfield 1, Mass.; Pasadena 3, California. (Note: East of Rockies address Springfield office.)

BRAND NEW! Amazingly different and smart Christmas cards bring you big money! Take easy orders fast! Pays up to 100% cash profit. With name 50 for \$1.50. Big line. Sensational Glo-in-the-Dark ornaments, personalized stationery, matches. Several \$1.00 boxes on approval. Imprints free. North Star, 31 Glenwood, Dept. 16-L, Minneapolis, Minn.

MONEY For Xmas. Make at least \$50 showing beautiful Elmira Christmas and all-occasion greeting card assortments—Name imprinted Christmas cards, stationery, napkins, book matches, playing cards. Gift wraps, books, games, household, hostess items. All unbeatable values. Make money while you make friends. No experience necessary. No risk. Send no money. Free samples, catalog. Bonus plan, display assortments on approval. Write today! Elmira Greeting Card Co., Dept. C-174, Elmira, N. Y.

DROP Everything! Sensational earnings now to Christmas with fastest-selling, popular-priced personal Christmas cards, name-imprinted. Also album of deluxe designs. Box assortments too. Send name for samples. Wallace Brown, 225 Fifth Ave., Dept. E-4, New York 10, N. Y.

MEXICAN Feather pictures. High profit! Fast sellers! Adelphi, Box 57-B, Bellrose 25, N. Y.

BALL Pens \$10.00 gross; d.e. s.e. blade \$4.20 M; novelty flashlights with batteries \$2.25 dozen; assorted ruffled plastic aprons \$1.40 dozen up; imported jackknives \$1.75 dozen. Lutzker, 871-A East 170th, New York City 59.

AGENTS. Salesmen, distributors. Real money every day. Give auto windshield 1953 look. No more glare from sun, headlights, etc. Auto owners buying now. The newest rage—Tinted windshields for all cars, trucks. One minute demonstration sells new miracle Spray-A-Tint, lasts for years, season just starting. Thousands satisfied customers. Enormous profits. Sample free. Write Spray-A-Tint Co., Consumers Bldg., Dept. PM-8, Chicago 4, Illinois.

ONE Hour a day can bring you \$500 or more for Christmas. You can have extra Christmas money simply by showing Fanmour's nationally-known line to friends and neighbors. Everyone wants Christmas cards, stationery, notes, napkins, children's items, gifts. Folks just like yourself with no experience at all easily earn \$500 in just one hour a day with Fanmour's 100% Profit Plan. Free imprint samples. Selling outfit on approval. Write today! Free! Organization fund-raising plan. Fanmour, Dept. PM, 200 Fifth Ave., New York City.

FALL Sale. Power mowers—\$36.20, Pre-paid. Act quick. Rotacut-PM, Excelsior Springs, Mo.

SELL Big money maker to men and women. Easy handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 84, Massachusetts.

FREE! Wholesale buying secrets. Sources for thousands nationally advertised products. Big discounts! Continental, 245 Taunton, Buffalo 16, N. Y.

HANDSOME Alligator grain billfolds. Removable pass case, secret bill compartment. Brown or tan. \$5.00 dozen postpaid, boxed \$5.50. Samples 2 for \$1.00. Crescent Sales, 150 Broadway, New York 33.

NEW Automobile safety device. Absolute necessity. Sure fire seller. Big money maker for go-getter salesmen. Formost Auto Specialty, 7559PM South Chicago Avenue, Chicago, Illinois.

MEN, Women, make money spare time plus new car as bonus for encouragement. Amazing hosiery guaranteed to wear without holes, snags, and runs, or replaced free. For example, lovely 60 gauge nylons guaranteed for as long as 1½ years, or replaced free. Write Wilknit, 1738 Wash., Greenfield, Ohio.

WHOLESALE Catalog. Nationally advertised appliances, watches, etc. Send today for free catalog. Carroll Distributors, 4421 Snyder Ave., Brooklyn 3, N. Y.

HANDLE Stamp packets for quick profits. Part time or side line opportunity for easy sales to various outlets. Commission basis. Write for sample and information. Pot-O-Gold Stamps, Litchfield, Conn.

TWO IN ONE screwdrivers. Sample 88c net. Money maker. Ideal Service, 2101 Barclay, Oklahoma City 14, Okla.

MAKE Your dreams of success come true! We can show you how. Sell direct exclusive Spring-Step cushion shoes—A new idea in foot comfort. Earn up to \$25 daily! Full or part time. Free sales equipment! Write today! Dept. PM-83, Ortho-Vent Shoe Co., Salem, Va.

WOMEN'S Cosmetic razors \$12.00 gross. Nucleus, 2440 Amsterdam Ave., New York City 33.

A Postcard can put you in a fine business! Complete line. Leather jackets, 151 shoe styles. Big commissions. No experience, no investment. Send postcard for free outfit. Consolidated Shoe, Dept. CC30, Chippewa Falls, Wis.

LET Me show you how to make \$25 or more in a week showing Melville styles to friends, neighbors. Write me personally. Give name, address, age, dress size. Mr. B. J. Melville, Pres. Melville Co., Dept. 8124, Cincinnati 26, Ohio.

LIVING Pictures of Jesus. Sample \$1.50. Miller's Sales, 419 Winkler, Louisville 8, Kentucky.

A Dress-lingerie shop in your home. No investment. Good commissions. Write for sample book. Modern Manner, 260PA Fifth Avenue, New York.

TERRIFIC Bargains—Profits! Used suits \$1.15, pants 35¢, dresses 20¢, shoes 20¢. Operate from store, home, car. Free catalog. Superior, 1250-A Jefferson, Chicago 7.

200% PROFIT Offering lost key service. Millions prospects. Literature free. Lucky Key Service, P.O. Box 44-P, Cleveland, Ohio.

PRINTING, Salesbooks, envelopes. Free illustrated catalog. Erco, Dept. PM, Bronx 72, N. Y.

NEW Bathroom deodorizer. Hangs on wall. Banishes odors bathroom, kitchen. Lightning seller. Samples sent on trial. Kristee 122, Akron, Ohio.

GOLD Silver lacquered letters. Windows, doors, trucks. Standard sizes. Penny and up. Big profits. Samples. Atlas-D, 544 West 79th, Chicago 20.

MAKE Extra money. Sell front door name plates to friends, neighbors. Retail \$1.98; you make \$1.00! Free selling kit. Modern Engraving Co., P.O. Box 194, Boston 14, Mass.

ABSOLUTELY FREE—Sales kit. Yours for the asking. Send postcard today requesting kit showing new line, belt buckles with your name or personal initials, cap badges, choice 3000 different emblems. Write Hook-Fast, Box 1425PM, Providence, R. I.

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YOUR OWN BUSINESS—Used suits \$1.50, overcoats 65¢, mackinaws 35¢, shoes 12½¢, ladies coats 30¢, dresses 15¢. Enormous profits. Catalog free. Moro, 558-AA Roosevelt, Chicago 7.

AGENTS: Stamping names on key protectors. Sample 25¢. Stamping outfits, checks, social security and name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

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EXCELLENT Sideline for printing and advertising salesmen. Decaleomania name plates in small quantities. Great demand. Also, make money with our line of automobile initials and sign letters. Free samples. "Raleo" XL-Roxbury, Boston 19, Mass.

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SELL Harmar's French fried popcorn to stores and taverns. Fast repeater. Harmar Products Co., Hammondsport, N. Y.

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1953 WHOLESALE Dealer kit on appliances, typewriters, recorders, cameras, giftware, lighting fixtures. Free. Write Arrow Distributing, 154K, Nassau St., New York City.

150% PROFIT Demonstrating amazing new perfumed waterless hand cleaner. Write, Hill Sales Co., Waynesburg 8, Penna.

\$1.00 PROFIT Selling \$2.95 photo enlargement deal. Allen Studio, Riegler Bldg., Little Rock, Ark.

WHOLESALE Catalogue! Nationally advertised appliances, cameras, watches, etc. Cam Company, 1717PM—58th St., Brooklyn 4, N. Y.

SALES MEN—DISTRIBUTORS

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AD MATCHES! Sell amazing designs—20, 30, 40 and 240-light book matches. Bigger spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience: men, women; full, part time. Buy nothing! Sales kit furnished. Match Corp., Dept. PM-41, Chicago 22, Illinois.

MAN Earn \$500 monthly. National company. Exclusive territory. Full or part time. Prospects everywhere. Big profit. Unusual automatic fire extinguisher. Write Superior Products, Inc., Dept. 144, 3410 Main, Kansas City, Mo.

MAKE Money with fast-selling Bostonian shirts. Blouses, too. Spare time, full time. Sales kit free. Bostonian, 89 Bedford, Dept. A-10, Boston 30, Mass.

ANYONE Can sell famous Hoover uniforms for beauty shops, waitresses, nurses, doctors, others. All popular miracle fabrics—Nylon, dacron, orlon. Exclusive styles, top quality. Big cash income now, real future. Equipment free. Hoover, Dept. R-100, New York 11, N. Y.

SELL Educational children's advertising specialties. Rocket Advertising Co., Carthage, Mo.

\$50-\$100 WEEK In your spare time! You've read about it. Reflector tape for car bumpers, house numbers, 100's of uses. Visible ½ mile away. Sells itself. Send \$1 for 5 ft. sample, proven sales plan, quantity discounts. Volume Sales Co., 3930 Sunset Blvd., Hollywood, Calif.

FREE Sample to calendar, novelty salesman: Advertising tape measure, commission 25%, advanced. State experience. Nationwide. Arlington, Texas.

ANY Gift shops, individuals can sell purses, belts and other handmade typical items from Guatemala. Free catalog. Use airmail. Maplon, Box 268, Guatemala, C. A.

SALESMEN Make up to \$50 in a day selling brand new item going to every type of food and beverage store, factories, laboratories, hospitals, etc. Samples furnished. Utility Durawear, 33 West Jackson Blvd., Dept. PM8, Chicago, Illinois.

OKURA Rubber base pays 300%. New miracle coating protects, preserves, glamorizes floors, walls, linoleum, furniture. Resists acids, soap, water, alcohol. Damp-proofs wet cellars. Big seller. Everyone needs. Rubber Products Co., New Haven 49, Conn.

AMAZING Westinghouse equipped electronic deodorizers sell on sight. 100% profit on every sale. Send for free selling plan. Rid-All Corp., Hoosick Falls, N. Y.

2500 SPECIALTY Manufacturers require salesmen. \$1.00 registers you. Contacts, Chicago 4.

AGENTS, Salesmen buy standard brand merchandise at rock bottom wholesale prices: \$49.50 watches at \$22.95. \$49.50 dinner sets at \$15.60. \$1.00 ladies 1st quality nylon hose at \$6.50 per dozen, \$14.95 rhinestone sets at \$2.50. Minimum order \$10. F.O.B. New York. Sent \$1 for catalog with confidential price list. (Refundable first order.) Bargain Merchandise, Dept. P, P.O. Box 66, Bronx 59, N. Y.

ADVERTISING Book matches—Cash in on big demand; sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit, low prices, protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. M-853, 7530 Greenwood, Chicago.

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NEWLY Patented, self-filling brush and ink combination. Storekeepers can't resist. Sign-Riter, Inc., 261 Great Arrow, Buffalo 7, New York.

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WELDING Training pays at Hobart Welding School, Box M-831, Troy, Ohio. VA contract. Best equipment. Catalog free.

INCREDIBLE! Become mental superman overnight! Free booklet! Bijou, Box 1727-MB, Hollywood 28, California.

COMPLETE Your high school at home in spare time with 55-year-old school. Texts furnished. No classes. Diploma. Information booklet free. American School, Dept. XC45, Drexel at 58th, Chicago 37, Ill.

PLAY Piano by ear. Write Mackey, 422 Warren, Hudson 1, N. Y.

WANT A diesel job? New opportunities to increase income. Higher pay. More money. We can help you qualify. Tools. Shop method home training. Write today! Diesel, Tractor, Heavy Equipment Division, Interstate Training Service, Dept. B3H, Portland 13, Oregon.

HIGH School—No classes. Study at home. Spare time. Diploma awarded. Write for free catalog HF-35, Wayne School, 2527 N. Sheffield, Chicago 14, Ill.

BE A real estate broker. Study at home or in classrooms in leading cities. Write for free book today. G.I. approved. Weaver School of Real Estate, 304 Law Bldg., Kansas City, Missouri.

STRUCTURAL Drafting. Home study. Drawing outfit and instruments furnished. Tuition \$69.00. Roth Tech., Dept. MB, Box 2283, Youngstown, Ohio.

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FREE Directory—1953 stepping stones to success. Denis Distributing Co., Suite 612, 216 W. Jackson Blvd., Chicago 6, Illinois.

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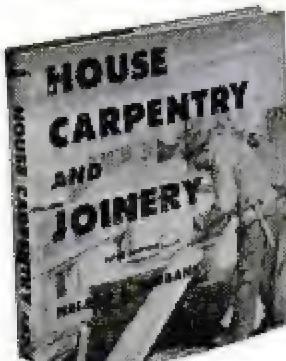
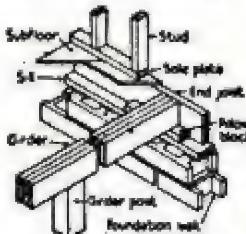
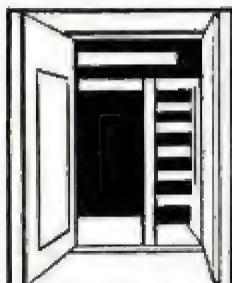
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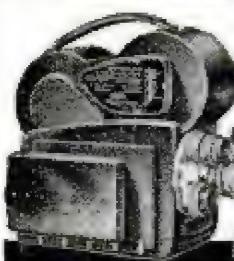


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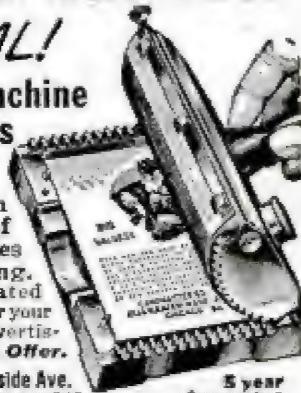
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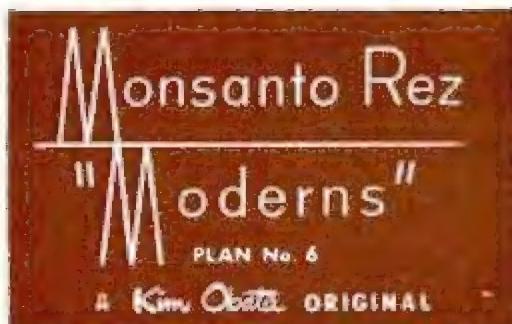
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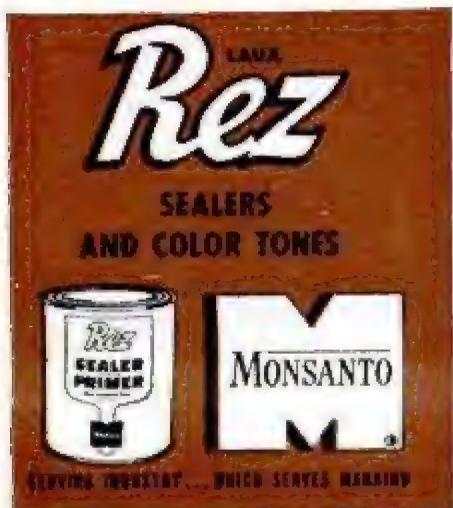
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POPULAR MECHANICS

AUGUST
1953

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 100 NO. 2

John Kelly piloted wartime freight "over the hump" to China on the night shift. I rode with him the other night—still on the night shift—over the hump of the Cascade Mountains. He drives

Truckers at all coffee-shop stops invariably pump driver Kelly for information on the "Boeing Special"



the **Turbojet** Truck... **Hottest on the Road**

By Rafe Gibbs

HOW'S the engine running?" It was an odd question that came through the night fog as trucker John Kelly eased out of his cab. He had just parked his truck and trailer beside a coffee shop on the summit of the Cascade Mountains in western Washington and the query was odd because it came from another trucker.

Usually, truckers don't ask one another at coffee stops how an engine is running. But it was no ordinary engine that nestled beneath the hood of John Kelly's Kenworth truck. In fact, it was the only engine of its kind in the world being commercially utilized in a freight truck.

The revolutionary engine, developed by the Boeing Airplane Company and being

pioneered for commercial-truck application by the West Coast Fast Freight, Inc., is gas-turbine powered. For the most part, its design is similar to that of a jet-airplane engine, but the gases which normally go out the tail cone are harnessed to turn a power-turbine shaft. That's why the men who fathered the engine don't like it

Less shifting of gears and more constant speed on hills results in less piling up of passenger-auto traffic





The "two stacker" moves easily through city streets. Pickup of the turbojet truck, Gibbs says, is good referred to as a "jet"—a common mistake.

"The size is the real stopper," says Kelly. "And that goes for truck-company efficiency experts, who are concerned with bigger pay loads, as well as the curious folk along the road."

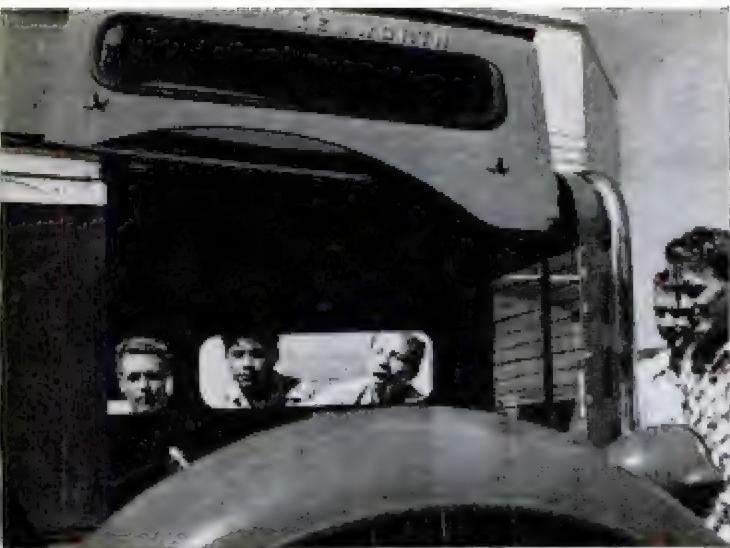
With 175 horsepower in "pony harness," the Boeing gas-turbine engine is only 40 inches long, 23 inches wide and 22 inches high, occupying less than 13 percent of the space required by a diesel truck engine. Weighing 200 pounds (plus about 60 pounds of accessories), it is 2500 to 3000 pounds lighter than present diesels of equal output. While the average diesel engine has 1400 parts and the average automobile engine 880, the gas-turbine engine has 400. Although normally operated with diesel

oil, it will burn high or low-octane gasoline, kerosene, stove oil or jet fuel.

To get a cab-seat view of the truck in action, I chose the 150-mile trip from Seattle over the Cascades to Yakima—a rugged test. I was told to report at West Coast's big freight terminal in Seattle at 9 p.m. Freight trucks, I knew, travel mostly at night, and I thought it was because there is less traffic on the road at that time. Not so, said trucker Kelly.

"Idea is to get the freight to the next terminal so it can be delivered early in the morning," he explained.

During World War II, Kelly hauled freight by night as an Air Force captain piloting transport planes—80 trips over the Burma-China "hump." He traveled by



Special windows are provided for the curious. Turbo-jet takes only 13 percent of space required by diesel

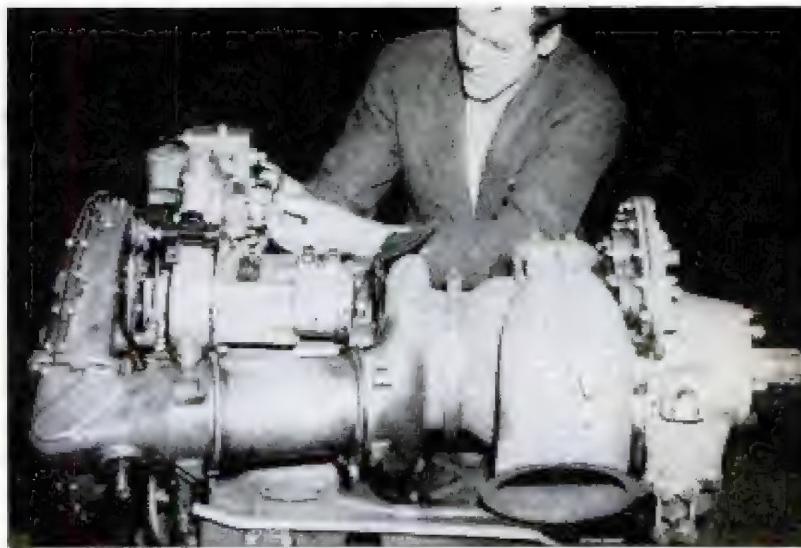
night then to escape Japanese fighter planes.

With 68,000 pounds of gross weight to be moved, Kelly pushed the starter button. As the fuel-pump pressure climbed quickly to 100 pounds per square inch, he opened the engine-control valve linked to the fuel valve. The engine fired.

A warm-up period is not necessary with the turbine, but Kelly, from long habit, let the motor idle a moment. From the two huge exhaust stacks on opposite sides of the cab came a low, even roar, like wind rushing through a cave. Mingled with this sound was a high-pitched whistle from the reduction gears. Like a singing teakettle; not loud, but steady.

"Should have heard the whistle before a silencer was put on," grinned Kelly. "You could hear it four miles away. Eventually, the researchers will probably eliminate the whistle entirely. But it doesn't bother me. I really don't hear it—most of the time."

Streamlined engine has only 400 parts; conventional diesel at right contains 1400, crammed tightly together



More research on the revolutionary engine is needed. Fuel consumption is heavy. Better alloys must be found

Engine vibration? There is none at all.

"I never get tired driving any kind of truck on a trip as short as this one," said Kelly, "but on longer runs the smoothness of the turbine engine cuts fatigue."

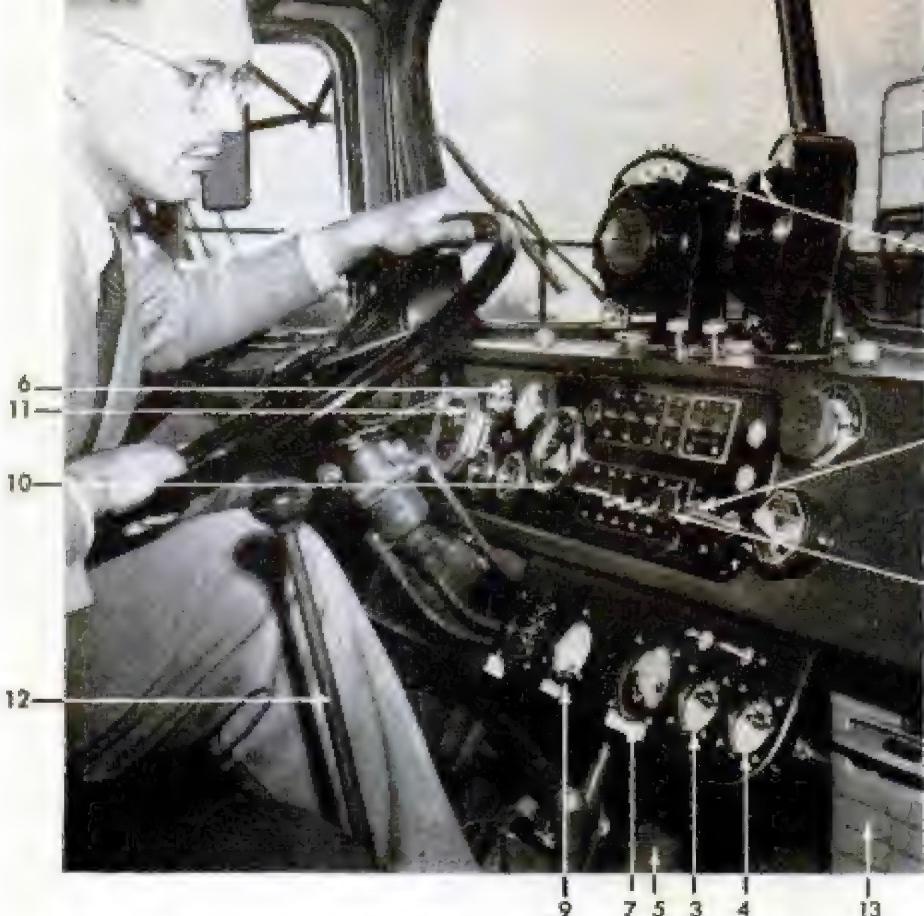
Kelly shifted gears. The truck moved off—easily, smoothly. With the ordinary diesel there are 15 gears; with the gas-turbine unit, six.

"Actually need only four," said Kelly.

Now we were pushing through Seattle's main streets, still heavy with traffic. We weaved past one slow-moving car, then another. Pickup was good.

With fascination I watched the dial showing the temperature of the gases entering the first turbine wheel. We were riding a "hot rod" indeed. At normal cruising speed, the temperature stood at 1200 degrees Fahrenheit. But there were sudden fluctuations, depending upon engine pull—down to 900, up to 1500. The ordinary





Cab interior mounts: 1. Starter switch; 2. Fuel cutoff; 3. Fuel-governor pressure gauge; 4. Fuel-nozzle pressure gauge; 5. Accelerator pedal; 6. Oil-pressure gauge; 7. Oil-temperature gauge; 8. Recording tachometers; 9. Exhaust thermocouple gauges; 10. Speedometer; 11. Compressor gauge; 12. Auxiliary shift lever; 13. Engine-oil heater

water-cooled diesel runs at about 170 degrees Fahrenheit and there are no fast changes unless something is wrong with the engine's performance.

The problem of the terrific heat was something to ask the Boeing scientists upon my return to Seattle. But now we were moving up the Cascade Mountains, dark shadows jagged with tall Douglas fir and hemlock.

Before reaching the summit at Snoqualmie Pass, we had about 3000 feet to climb. Some of the mountain grades are steep. On one of them, another West Coast freight truck—just like ours except that it contained a regular diesel engine—passed us. Kelly snorted. Then—crowning insult—a heavily loaded oil tanker eased past. Kelly snorted again.

"Don't think that these trucks passing us are showing up the turbine engine," he said. "We've got 175 horsepower under the hood. That other West Coast truck has 200. The tanker? Probably 250. Boeing is now working on a 220-horsepower gas-turbine engine. Put that under the hood, and we'll leave two thirds of the trucks on a hill standing still."

Loyal man, Kelly. But he knows his trucks. Off and on, he has been driving them for 16 years.

As we moved up another grade, a down-bound trucker flicked his lights in warning.

Kelly drove on with caution. Around a bend we sighted flares marking trouble: A big

truck had broken down on the grade and was still partly on the highway. Coming at us were three passenger cars. No room to swing around the stranded truck and pass. Kelly stopped his machine dead on the hill.

Then, as the traffic cleared, Kelly, looking pleased, said:

"I'm glad we had to make this stop on the hill, because now I can demonstrate a very neat trick. When we stopped, the truck was in direct second. Now watch!"

And, without the shifting of a gear, the truck began to move up the hill again.

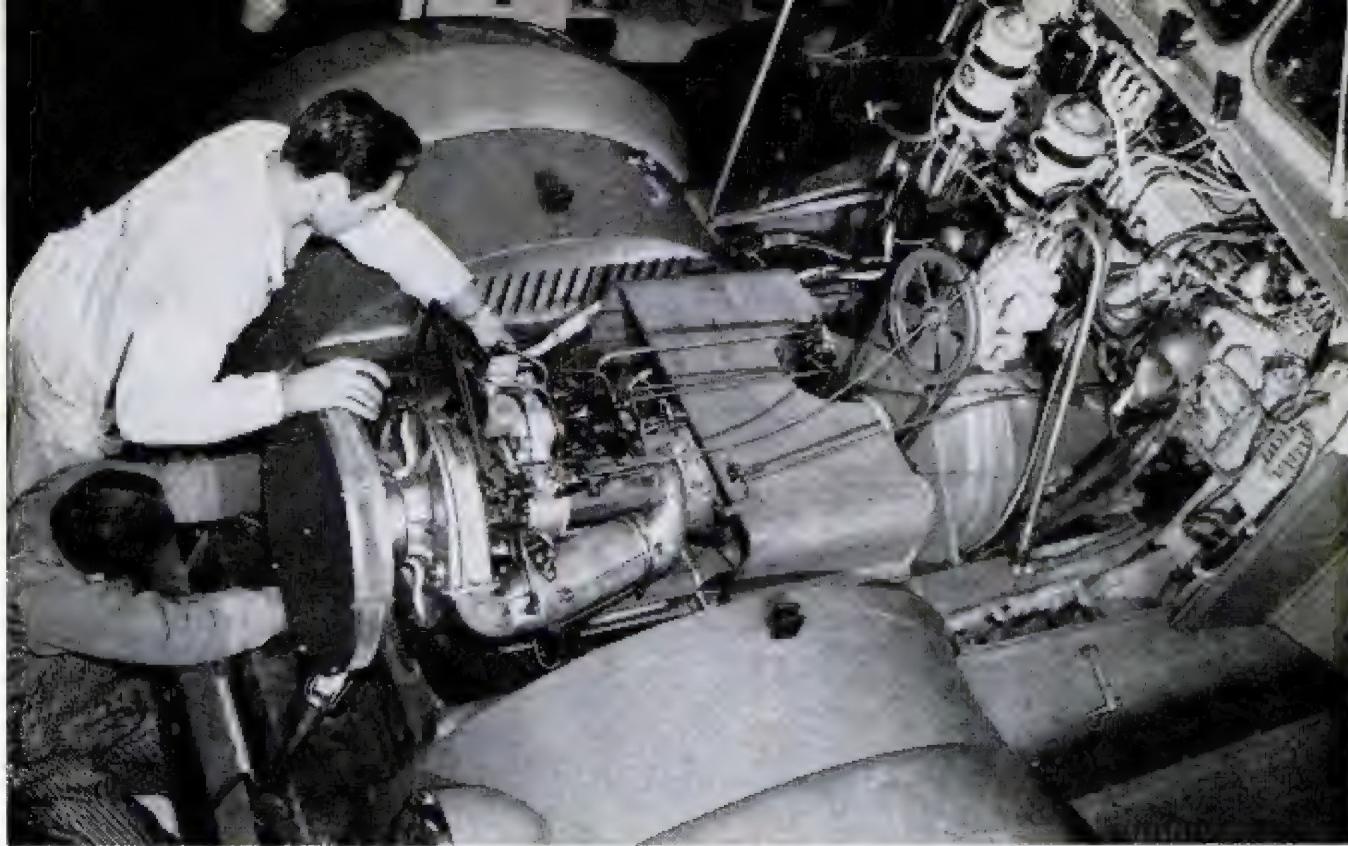
"With a conventional truck," Kelly pointed out, "I would have had to go back to first gear. It would have taken three shifts to get back to direct second. With this

engine, you start climbing again with the same gear in which you quit."

At the summit, we pulled up to the beckoning neon lights of the coffee shop and that's when the trucker asked Kelly

Armed Forces are intrigued by the variety of fuels burned by the engine and its small number of parts





Two men can change engines in four hours. Lightness of the turbojet means that one man can handle any part

how the new turbojet engine was running.
"Hot, but smooth," grinned Kelly.

Inside the coffee shop there were a half dozen other truckers equally curious about the "Boeing Special." There are probably few truckers on the West Coast who haven't heard—or heard about—the gas-turbine engine, for it has made a test run from Canada to Mexico.

As the truckers drifted out of the coffee shop, they stopped to peer at the engine. And "peering" has been made easy—both sides of the engine hood have glass panels. Inside is a light which Kelly flicks on for the benefit of nighttime spectators. We could see in the truckers' eyes an unasked question:

"When do I get a chance at one?"

Something else to ask the men at Boeing.

Our ride down the east slope of the Cascades and over the winding canyon road into Yakima was uneventful—except for the dog. Outside a farmyard near Ellensburg a yellow mongrel stood unmoving in the glare of the headlights as we approached. Then, as the truck whined within 100 feet, he spun around twice and tore into the yard. Kelly chuckled.

"Dogs hear more of the high-pitched sound from the engine than humans," he said. "Sometimes they just stare at the truck in astonishment, and sometimes they react like this one. Cops also seem to be supersensitive."

"One night I was moving down a street in Yakima when a policeman stepped out from the curb waving a flashlight. I stopped and we had a little conversation. 'Do you

know how fast you were going?' 'Sure—20, maybe a little over.' 'Know what the speed limit is?' 'Yes, 25.' 'Well, you sure sounded as if you were going faster.' After I had showed the cop the engine and explained why it sounded the way it did, he thumbed me on. Said, 'I wouldn't have missed stopping you and finding out about this truck for anything.' "

Several times, Kelly added, the truck has been stopped by state highway patrolmen more interested in inspecting the truck's unique engine than its cargo.

At 2:30 a.m. we pulled up at West Coast's Yakima terminal. Our actual running time for the 150-mile trip was about 4½ hours.

Back at Seattle, I went out to the Boeing Airplane Company's big No. 2 plant and learned about the first actual trial of the truck which made history. Lloyd E. Hull, project engineer for installations in Boeing's industrial-products division, described it. "It was March 1950. The engine had been put through all its paces in the laboratory, but no one really knew how it would function pulling a truck," said Hull. "You always hate to try out something new when there are a lot of curious onlookers, so I waited that night until everybody except the watchmen had gone home."

"Then, by my lonesome, I climbed into the truck with the newly installed engine, stepped on the starter and moved off. I drove the truck up and down the airplane-parking apron—past a row of B-50s. The engine functioned perfectly."

The Boeing Airplane Company didn't
(Continued to page 244)



As the jet-powered *White Hawk* picks up speed, it climbs up onto its hydrofoils, reducing surface drag

Jet Hydrofoil Shoots at World Record

SPEED IS RELATIVE. Man has gone 700 miles per hour in an airplane, 400 miles per hour in a car, only 178 miles per hour in a boat. But any boatman knows that there's nothing dawdling about 178 miles per hour on water!

However, two Britishers, Mr. and Mrs. Frank Henning-Lee, aim to break that speedboat record with their jet-powered craft, the *White Hawk*, on Lake Mead,

Kerosene-burning, the 4000-horsepower Rolls-Royce jet engine is on loan from the British government

Nev., this fall. The man-and-wife team collaborated on the design. Mrs. Henning-Lee (an American by birth) is the driver.

They have made a hobby of hydrofoils. Therein is the secret of their craft. These hydrofoils correspond to the airfoils or wings of an airplane, lifting the hull clear of the water to reduce drag at high speeds. The 20-foot boat has a 12-foot beam. Its Rolls-Royce Derwent jet airplane engine

At rest, the boat looks like a wingless plane. Arrow points to hydrofoil that supports boat at high speed





Mounted on a trailer, the boat is wheeled into the water for a test. One hydrofoil is seen near the cable

develops 4000 horsepower.

A propeller-driven boat tends to lift its bow because of the low position of the thrust. A jet boat tends to push its bow down into the water. To overcome this tendency, the designers broadened the forward hull. At top speeds, the hydrofoils keep the nose from burrowing into the water.

Another Englishman, John Cobb, went after the record in a jet boat in 1952 and was killed when it exploded during a speed run. His boat was a flat-bottomed hydroplane with heavy surface drag. The Henning-Lees say their hydrofoil design eliminates this danger.

Top speed of the boat to date is 125 miles per hour. But that was loafing along on a stability run in England. When Stella Henning-Lee opens it up on Lake Mead, she is certain that the speed record (now held by Stanley Sayres and Slo-Mo-Shun IV) will be held, for the first time, by a woman.

★ ★ ★

Below the exhaust nozzle of the jet engine is a horizontal tail not unlike those on airplanes. Vertical fin is also similar to aircraft design





Plastic-body shell of the Brown and Hooper car is sanded and trimmed before removal from mold

Speedsters on the Salt Flats

THIS MAY BE the year, experts say, for America to break 300—300 miles per hour, that is. And next year may bring the topping of the record of 394 miles per hour set by the late John Cobb of England.

One likely contender for these honors is a car built by an amateur—a tile setter by trade, a hot rodder by avocation. He is Eugene Le Blanc of Cupertino, Calif.

If all goes well, his 3000-pound car will roar across the Bonneville Salt Flats in Sep-

tember. Throbbing under its plastic body will be 1000 horsepower from two souped-up Chrysler V8 engines. Each will power its own axle, providing a four-wheel drive.

New this year is a Firestone tire made to go 300 miles per hour. It's an offshoot of a jet-fighter tire, but has a different tread.

One of the problems at such speeds is to keep the car from becoming airborne. The Le Blanc car was designed nose down to avoid this. Micro Switches on the axles

Front end of tubular frame of the Brown car showing position of driver. Right, rear suspension is de Dion



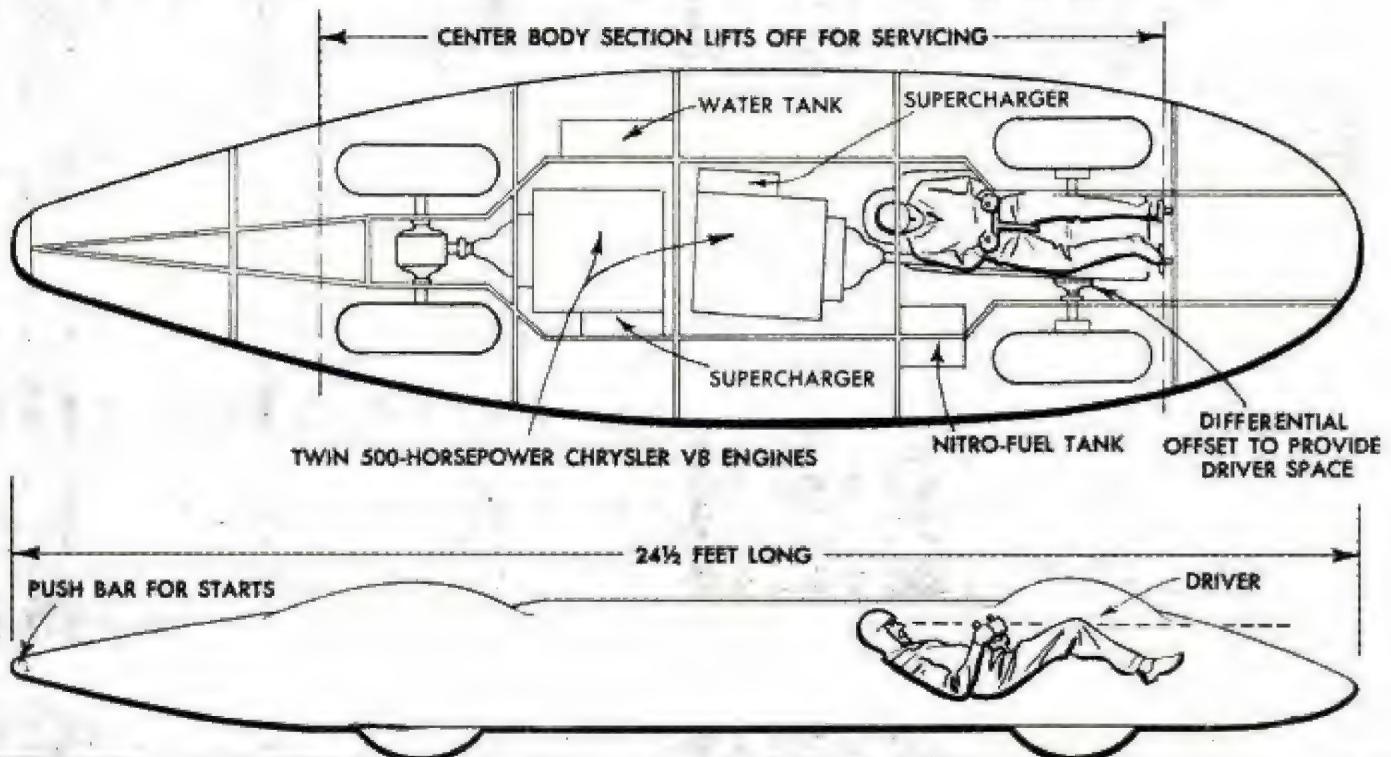
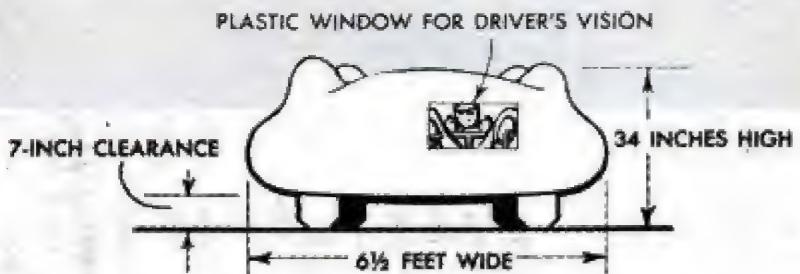
detect any lightning and warn the driver by a red light on the dash and a buzzer in his helmet.

Another Bonneville car is the Brown and Hooper Class C streamliner. Also Chrysler-powered, its single engine is sleeved down to a 301-cubic-inch displacement. Compression ratio is 14:1 and expected top speed is in excess of 250 miles per hour. ★ ★ ★

Plaster mold over which the Le Blanc body was formed



Le Blanc, right, watches driver George Hill try his seat. One of the two engines is in place. Hill holds record of 229 miles per hour, set last year. Below, drawings of Le Blanc car. Note the driver's position



Will the New Submarines Rule the Seas?

By Rear Adm. Charles B. Momsen

Commandant, First Naval District

WE ARE ON OUR WAY to building submarines that can travel faster underwater than on the surface. The submarine of the future will be shorter and fatter than present designs to provide a more efficient underwater shape.

It will cruise at 30 to 40 knots submerged and if necessary could develop a fantastic 60 knots, hundreds of feet below the surface.

Such high speeds are impractical for large surface vessels because of unavoidable bow-wave power losses. This handicap doesn't exist at cruising depths and, in addition, the submarine is not affected by adverse winds and seas.

Our present submarines operate like dirigibles. They have neutral buoyancy when submerged, just as has a lighter-than-air craft in the atmosphere. The high-speed submarine of the future may be more comparable to an airplane that depends on airfoils for lift. We may employ positive buoyancy and use extended hydrofoils to drive us down to a desired operating depth. The same hydrofoils may hold us there while cruising. They will be somewhat different from the hydrofoil shapes now used for changing depths, for the problems of control will be multiplied when speed increases.

The advantage of positive buoyancy is that the submarine would always "fall up" to the surface if it encountered any crippling situation. Only a major flooding of its compartments could send it on down to crushing depth.

Submariners are studying all possible developments such as these because the struggle for sea power in the future will reach a decision underwater. More than half the Japanese naval and merchant tonnage lost during World War II was sunk by United States submarines and, in turn, the Allies lost 2750 merchant ships to Axis submarines.

It has become as important to gain control of the region under the surface as it is to hold control of the air. Eventually submarines will be pitted against submarines in grim under-sea battles, each casualty being marked by an enormous underwater explosion, an upheaval of water and debris on the



Admiral Momsen is one of this country's most illustrious submariners. During World War II he served as commander of two submarine squadrons and, until recently, directed operations of all submarines in the Pacific. He is also co-inventor of the famous Momsen escape lung.





U. S. Navy photos

Bulbous bow of killer-type submarine, designed to battle other subs, houses secret long-range sonar gear

surface, then silence. The side that is victor in a major undersea engagement will have the loser's surface ships at its mercy.

In comparison to surface ships and aircraft, the submarine is still crude and primitive. At present there is no commercial use for submarines, so we do not benefit by having great industrial backing as is the case with surface ships and aircraft. Compared to them, the submarine not only is underpowered, it still is a compromise vessel made up of pieces of equipment designed originally for other purposes. Today we are beginning to develop our own machinery to fit the special requirements of under-

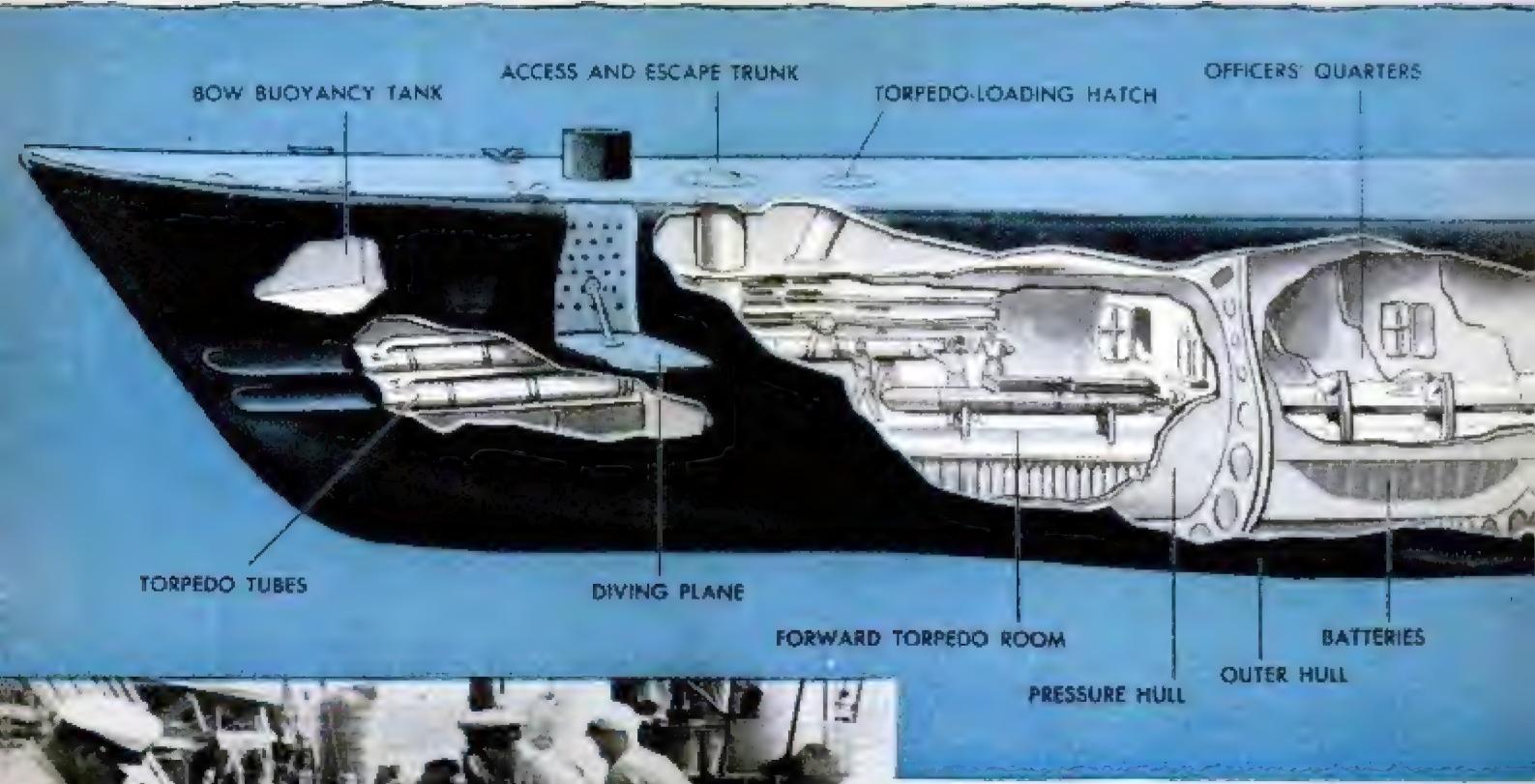
sea travel, replacing the compromises.

Among the many improvements we are seeking for American submarines are new types of power plants that do not depend on oxygen in the atmosphere for combustion. At present we are limited to heavy storage batteries for underwater movement. These can drive an undersea boat at moderate speeds for only a few hours. The new snorkel breathing tube is merely an expedient that carries air to a submarine's surface diesels while running barely submerged. The snorkel will be abandoned as soon as something better is found, for it is an obvious visual and radar target for enemy eyes. In place of it, the Germans tried hydrogen-peroxide and liquid-oxygen fuels, but they could not carry large enough supplies of these chemicals for extended underwater movements.

The nuclear power plants being built for the *Nautilus* and for a second experimental submarine, the *Sea Wolf*, are a big step

Experimental submarine is a personnel carrier for amphibious raids. The big tank houses landing craft, equipment for landing parties





Electric torpedoes are slipped carefully through the hatch and down into the torpedo room. Torpedoes are designed to "home" on enemy craft. Below, submariners prepare to test famous Mammesen lungs, named after the author, who is co-inventor of device

U. S. Navy photo

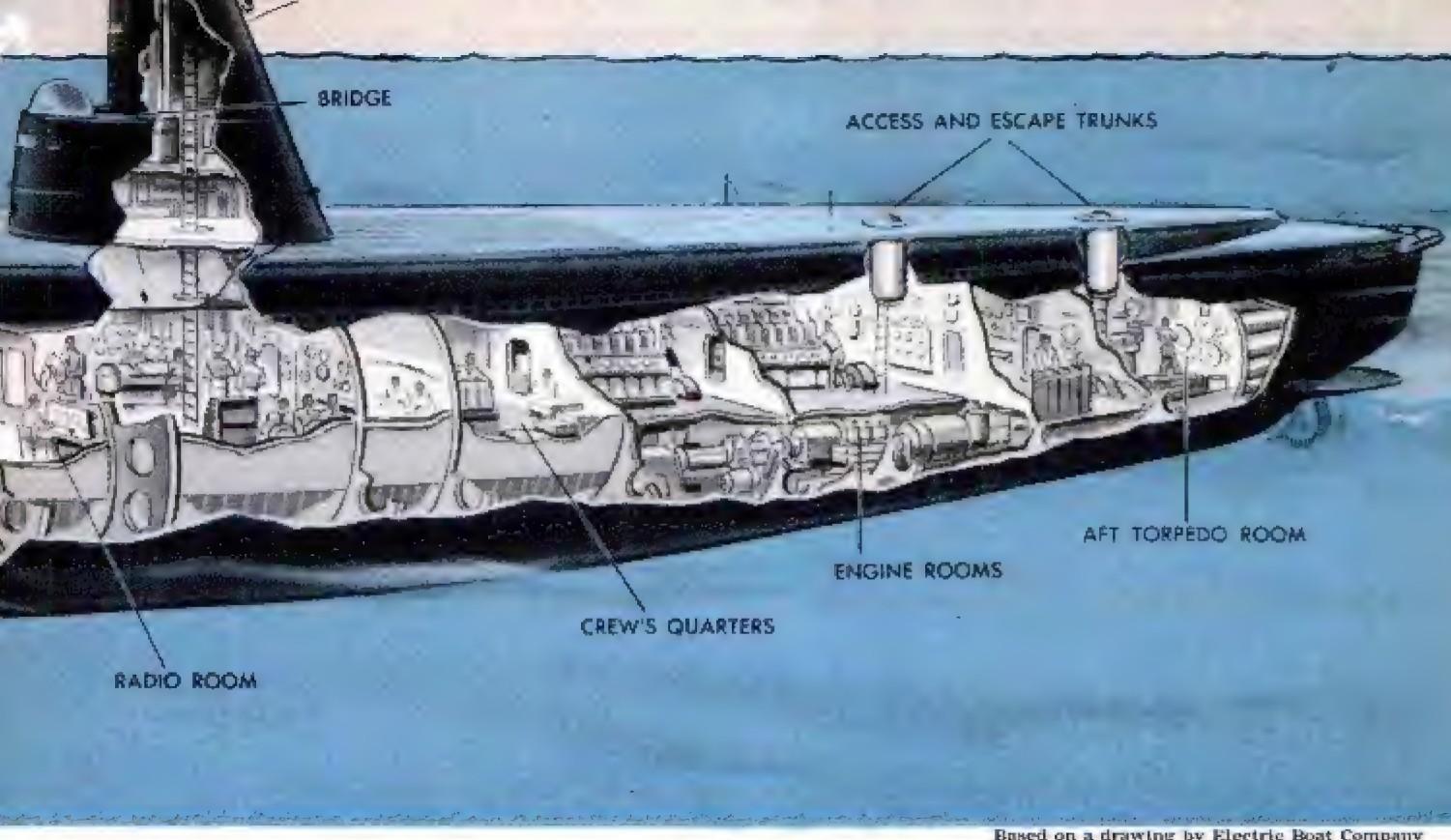


ahead. Nuclear power will give high submerged speeds and will permit underwater cruising for weeks on end at any practical depth.

Air for the crew will be provided by a conditioning system that removes carbon dioxide as it accumulates and admits fresh oxygen into the living spaces. The oxygen may be drawn from high-pressure storage flasks or it may be extracted from the sea itself. Recently a medical officer and 22 men were sealed in a submarine for a number of weeks to test the newest systems and to study the effects on human beings of long submergence.

It has been said, jokingly, that the nuclear submarines will be required to surface only once in four years and then merely to re-enlist the crews. This is hardly the case, but certainly these will be the first true submarines capable of deep travel for long distances.

The ultimate engine may not use nuclear fuel but may be an entirely new type that uses some substance which reacts with salt water. Some attention is being focused on the use of salt water as part of a chemical action to produce power. There are a number of substances that react with salt water in the way that a petroleum product unites with oxygen to form a combustible mixture.



Based on a drawing by Electric Boat Company

Cutaway shows the principal compartments of an attack-type submarine, the best of today's prenuclear subs

Another possibility is some new kind of primary battery that uses salt water as the electrolyte. Numerous pairs of metals, for instance, show a difference in potential when immersed in sea water.

Another thing we would like is a different method of propulsion. Even the *Nautilus* is old-fashioned in this respect, for its nuclear power plant simply drives a conventional steam turbine that, in turn, furnishes power to the propeller shafts. We need to get away entirely from reciprocating and rotary machinery and from propellers, for the sounds of these devices can be detected by modern sonar even at considerable distances. The ideal propulsion system would be utterly silent to avoid creating sound waves for enemy ears.

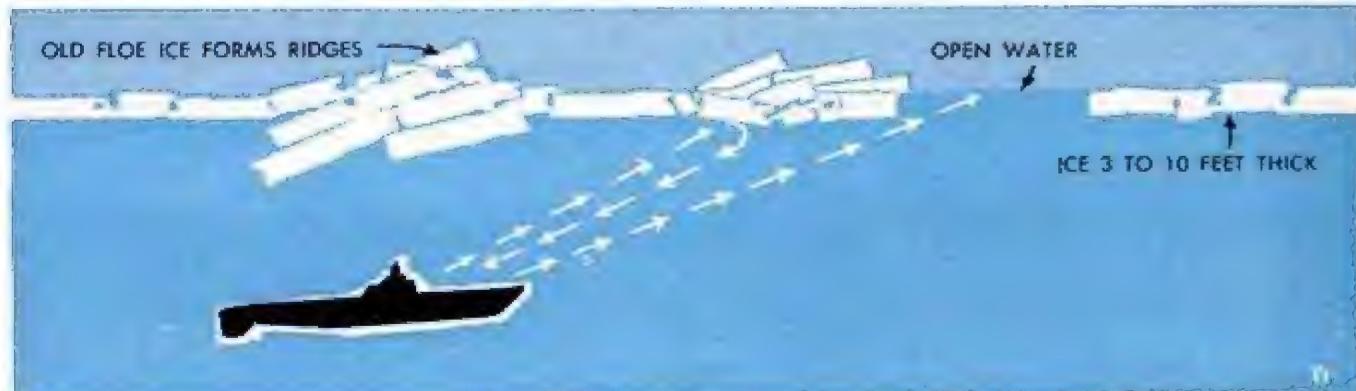
The fish is an efficient and silent swimmer. Many fish emit sounds, to be sure, but the sounds do not come from their locomotion. Recently I was fascinated by a little toy, a plastic fish powered by a rubber band,

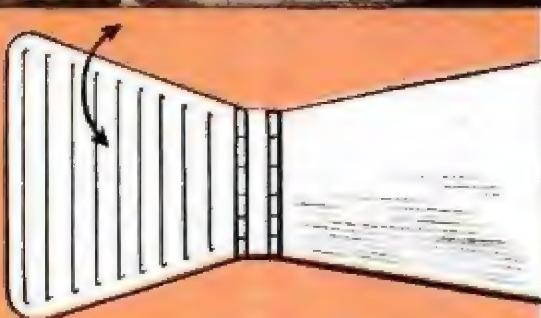
that travels the length of a bathtub with virtually no noise. A flexible submarine or one with a flexible tail, that moves silently and swiftly through the water, may be worth thinking about. Water-jet propulsion is another possibility for silent motion, as is some kind of sculling propulsion.

Navigation will be a real problem on the long underwater cruises we are contemplating. Observations of celestial bodies and even radio fixes would be denied to a submarine unless it made daily ascents to the surface for that purpose. Dead reckoning, fortunately, is somewhat more accurate underwater than it is on the surface. Too, frequent soundings of the bottom by the Fathometer method will be a great help. It has often been said that the bottoms of the seas are better charted than are land areas.

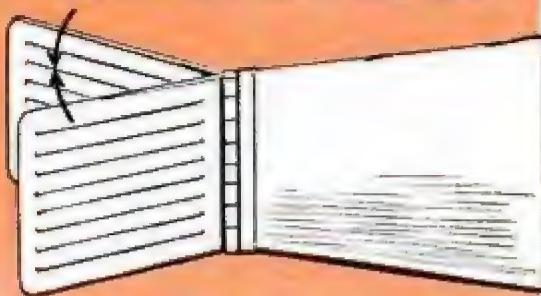
There is a real possibility that the world's goods can be carried more cheaply underwater than on surface ships as soon as improved submarines are built. The smaller

Submarines can cruise under the jumbled floes of arctic ice, using sonar to locate open water for surfacing

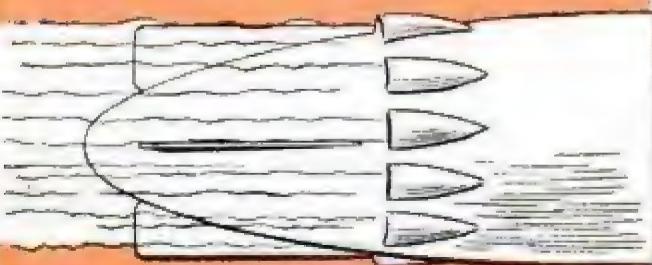




Alternate propulsion methods which have been suggested include the "fish tail" that would sweep back and forth. Hinged slats would shut on the power stroke, open on back stroke



Double-tailed submarine might have a pair of propelling surfaces that would swing together similar to the action of a frog's legs. Both blades would be made of slats to give maximum area on power stroke, minimum on return



Quietest of all propelling methods might be the water-jet system, where water is forced out under high pressure, moving sub forward

Author suggests that tomorrow's submarine, shown here as artist's conception, might fire missiles from beneath surface that would home on targets in air

amount of power required for subsurface travel is only one benefit. In some cases a submarine actually would shorten the distance between shipping points.

Surface ships can't cross over the top of the world even though great-circle distances across the Arctic Ocean are shorter than the routes used between many important ports. Yet transport submarines can be designed that would move safely under the polar ice.

Already a submarine has cruised for 22 miles under the ice off Alaska. This first exploratory venture by the *Redfish* revealed no unique hazards that can't be overcome. The icy ceiling, in general, has the same contours as has the upper surface of the ice, with a thickness varying from 4 to as much as 35 feet. There are rafted areas in the ceiling where ice has broken up, with slabs stacked topsy-turvy and then refrozen. These rafted areas project down from the ceiling but there is plenty of navigable water below them. The sea under the polar icecap probably averages 12,000 feet.

Submarines are safe from the ravages of storms since the effects of waves rarely reach 150 feet below the surface. In some areas there are subsurface currents that run opposed to the shallow surface currents, as in the Strait of Gibraltar. These often could be used to advantage.

Oil tankers in particular may some day travel underwater since it is easy to design
(Continued to page 230)



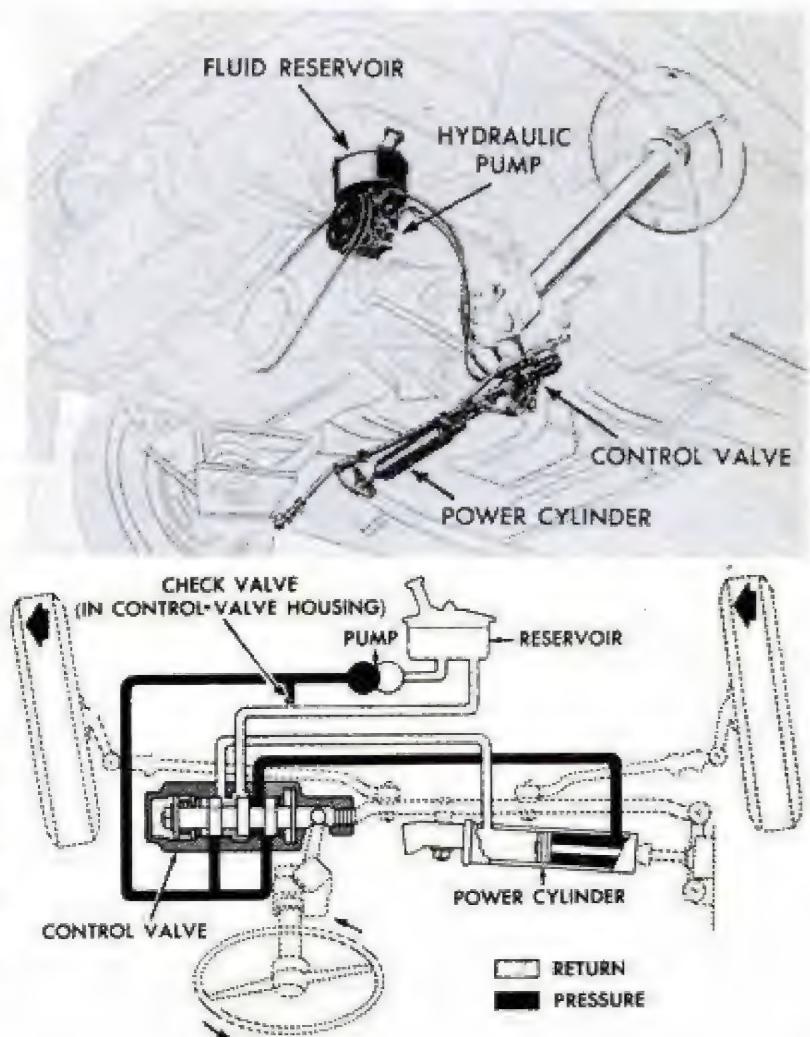
"Water Wings" for the Mighty Mite Permit Fording of Streams

Not even swamps or streams can now stop the Marine's Mighty Mite. An 86-pound kit carried in the vehicle permits it to float. Four lightweight rubber tubes, inflated by the exhaust, fasten to a frame

which is clamped to the Mite. Six jacks which hold the tubes to the frame lower them to floating position. In the water the Mite is propelled and steered solely by its wheels. Tire tread supplies the friction.

Ford V8 Power Steering

Ford has joined the list of cars offering power steering as optional equipment. Available on 1953 V8 models only, the system reduces steering effort by 75 percent when the car is stationary. At cruising speeds, a 3½-pound pull is required before the power assist takes over, thus maintaining the feel of the road. There are four main components in the system: (1) The hydraulic-fluid reservoir, located on the left side of the engine; (2) the hydraulic pump, directly beneath the reservoir and powered by a V-belt; (3) a control valve; and (4) a double-acting power cylinder mounted on the conventional-steering linkage. The unit has normal wheel-recovery characteristics. When a turn is completed and the steering wheel is released, the front wheels will return to a straight-ahead position—the power cylinder offering no noticeable resistance. Should the power unit fail, there is no appreciable increase in steering effort over that of the conventional, non-powered system.





Detroit Listening Post

By Leo Donovan

CHRYSLER IS EXPECTED to lead the new-model parade with the introduction of its 1954 line-up early in October.

Higher horsepower is expected to be the principal feature engineeringwise. Just where the "emergency reserve" horsepower rise will level off is not known yet, but informed speculation has it that Chrysler will approach 235 horsepower in the most luxurious models.

Chrysler's fully automatic transmission probably will not be available in all lines until the 1954 models come out, but it will be standard equipment on Imperial and Crown Imperial models for the rest of this year. (See story on opposite page.)

Chrysler has expanded its design and styling staffs and given them new freedom. You will spot the results in the high lights of the 1954 models immediately even though no great body changes are expected. Like most of the industry, Chrysler is aiming at 1955 for major model changes.

Design changes at General Motors for 1954 are still under wraps, but Chevrolet and Pontiac probably will provide the most eye-catching innovations. A more sloping hood line with recessed headlights is due on the new Chevrolet. The chrome strips, so long a part of the Pontiac hood and trunk decorations, may go on the fenders.

A tip-off on what to expect in compression ratios is provided by petroleum-company announcements of 96-octane gasoline. This premium fuel (at a higher price, of course) is most efficient in engines with higher compression ratios than are used in today's cars.

The so-called race for more horsepower and higher compressions is giving designers headaches, but so are the accessories and conveniences that have to be tucked under the hood. It's getting harder each year for the mechanic to reach the engine under a maze of parts which operate power steering, power braking, air conditioning, automatic transmissions, windshield washers and so on. But it's also getting harder for the designers to fit these items under the sloping hood that styling demands. And the weight of all this equipment is placing

a bigger load on the front axle, causing front tires to wear faster.

Higher horsepower and faster performance not only are more expensive but are giving brake engineers problems, too. Some believe that wheels will have to be larger to provide increased braking surface. Wheels up to 18 inches in diameter as compared with today's 15-inch wheel are being discussed. Stylists, meanwhile, want 13 or 14-inch wheels for a lower, sleeker look.

Larger, wrap-around windshields in the forthcoming models will provide better visibility for high-speed drivers. Ford, in its 50th-anniversary celebration at Dearborn, gave a clue to this in the scale model of its hardtop convertible that really converts. (See PM, July 1953, page 100.)

Fyou can expect Ford to have the new, sharply sloping windshield on a rakish future model that may be called the "Fair Lane," which is the name of the Henry Ford home in Dearborn, now the home of the company's archives. Greatly improved vision will be achieved through a windshield with corner posts set diagonally to eliminate blind spots, particularly on curves.

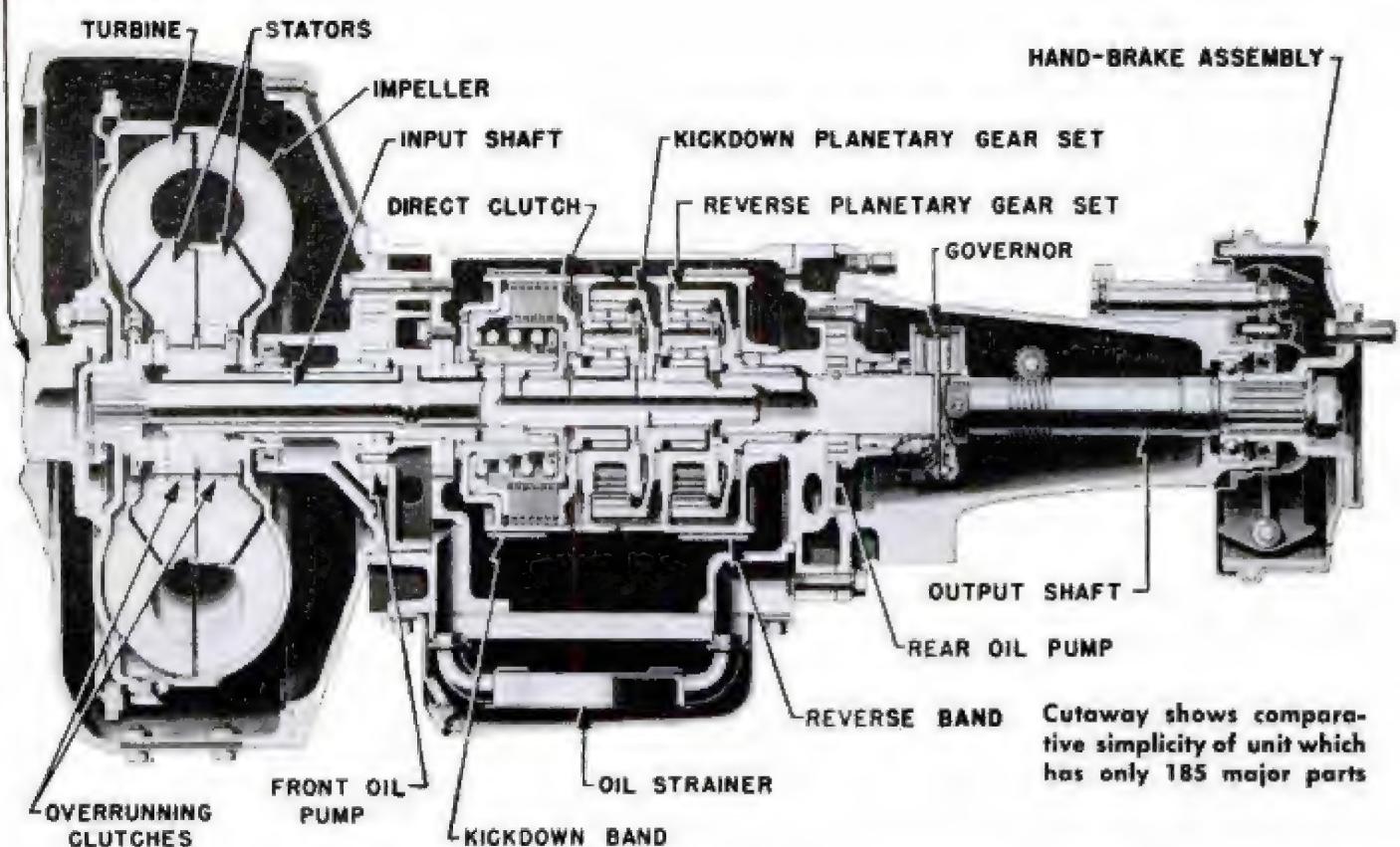
Chevrolet expects to produce 50 plastic-bodied Corvettes a month until January 1st. Total 1953 production is set at 300.

Gossip in the industry has it that Nash will build a four-door Rambler sedan on a 108-inch wheelbase in its 1954 line.

Hudson plans to build a sports car on its Jet chassis, but the unitized body-and-frame construction presents difficulties, especially if the body is to be made in Italy as some rumors have it. Hudson's step-down design should give it a lower appearance than most competitive American sports cars.

Synthetic upholsteries, longer-wearing and stainproof, will make further inroads on standard broadcloth and woolen fabrics in 1954 cars, Detroit stylists report. Some existing mills have increased production of the colorful fabrics and other companies plan new factories to meet the auto industry's demands. This may be the beginning of a trend which will make the seat-cover habit a thing of the past.

ENGINE CRANKSHAFT



Chrysler Drops Clutch Pedal With New Automatic Transmission

Lighter and with fewer major parts than any other unit on the road today, Chrysler's new automatic transmission also has the highest over-all torque multiplication. The torque converter itself is similar to previous Chrysler Corporation converters with slightly redesigned vane shapes. Overall torque multiplication of the transmission (converter and planetary system) is 4.47. Total weight is only 214 pounds compared with 250 to 314 pounds for competitive devices. The water-cooled unit has its own oil supply of 13 quarts. There is no clutch pedal and the clutch is of the multiple-disk type. Two planetary gear

sets are in the transmission—one the low or "kickdown" set, the other the reverse set. At speeds between 15 and 65, depending upon the throttle opening, the unit locks to a positive, direct drive. It can be downshifted into low by flooring the accelerator at any speed below 55 or by moving the shift lever to low at any speed below 65. Such a shift provides additional engine braking for steep descents and, at speeds below 60, greatly increases acceleration. The unit is installed as standard equipment on Chrysler Imperial and Crown Imperial models. It probably will not be available on other lines until the 1954 models.

Austin-Healey 100—British Sports Car Designed for U. S. Market

Handsome and fast, the Austin-Healey 100 has a high power-weight ratio. It accelerates from 0 to 60 in 11 seconds. Top speed is 110. It even has ample luggage space! Price tag of \$3000 includes taxes and equipment





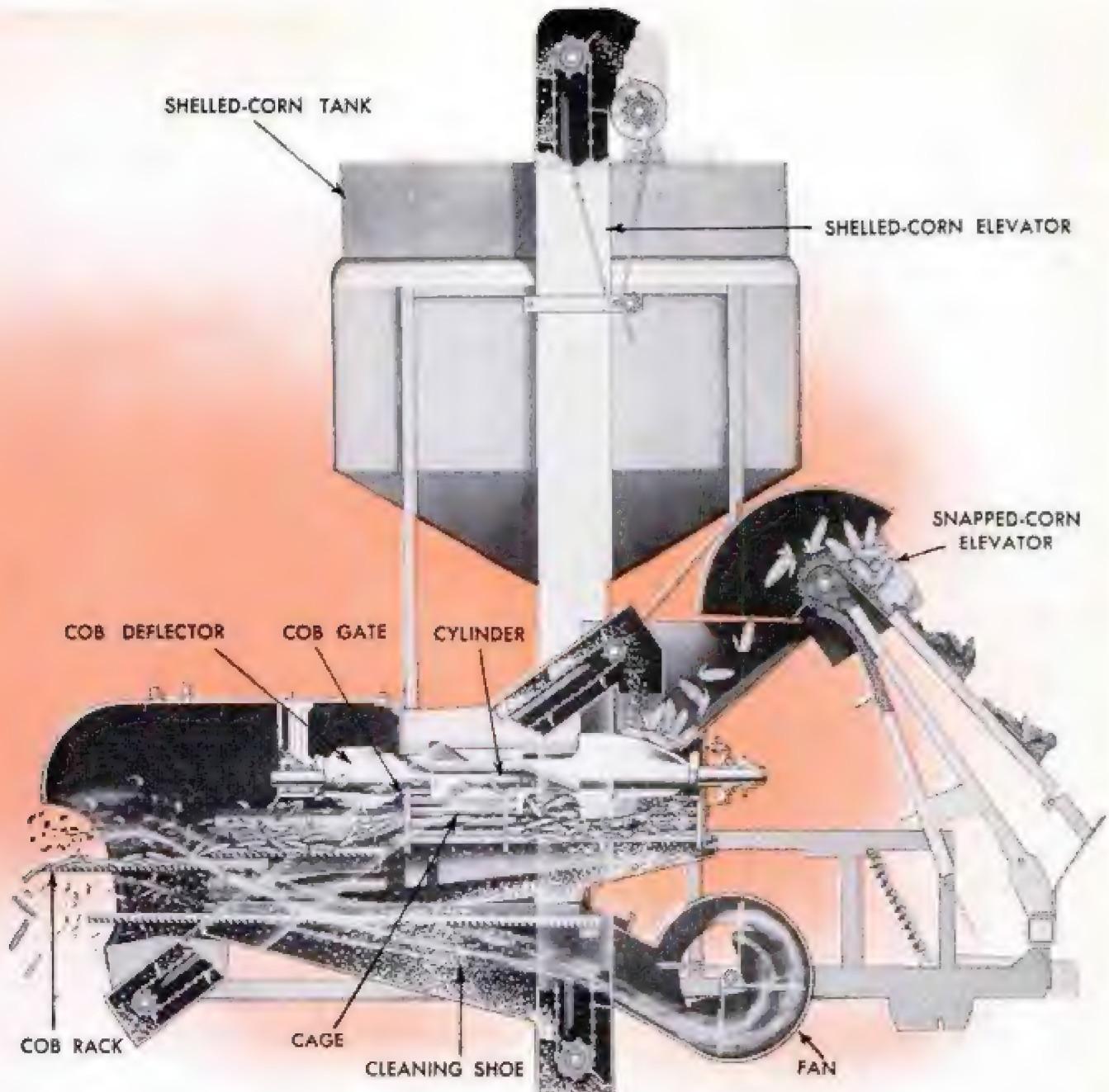
Minneapolis-Moline photos

Top, the harvester's combine attachment has a six-bat reel and a complete selection of sieves for the cleaning shoe to clean all small grains, beans, grass and seed crops



Center, the picker-sheller attachment rolls through a field, its four rolls snapping off the corn. Shelled corn moves by elevator to 37-bushel tank

Left, basic carrier has two big drive wheels on the front and is steered through the rear wheel. Attachments are slipped into place atop the heavy front axle and locked there with pins



In picker-sheller, corn moves up elevator and passes through shelling cylinder where kernels are rubbed off

ALL-IN-ONE HARVESTER *Carries Implements Piggyback*

AGRICULTURAL ENGINEERS have come up with a unique farm machine—an all-purpose harvester that resembles nothing that's rolling through the fields today. It's so versatile you can use it to pick and husk or field-shell corn in the morning, then make a quick change and drive it out to combine a crop of soybeans in the afternoon.

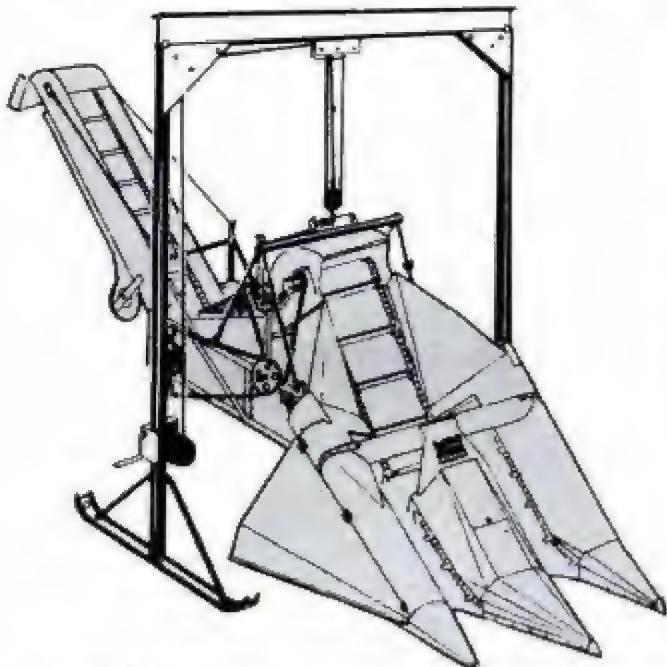
Basically, the harvester is a three-wheeled tractor unit that carries piggyback a variety of implements. Attachments at present (others are planned) will harvest all small grains, beans and seed crops; will

pick, husk and shell corn; and will pick up and chop forage crops. Thus, it wraps up in one machine all the equipment needed to handle the harvesting of virtually all the conventional crops. Less shed space for storage is needed, and the regular tractor can be made available for drawbar or belt work that needs to be done at the same time the harvester is at work.

The equipment includes a hoist for exchanging the piggyback implements and a carriage for moving them into storage and back out again. If the operator wants to pick and husk corn in the morning he simply



Operator, using corn picker and husker, has full view of the stalks from his vantage point high on the left side of the machine. There are ten 36-inch husking rolls, half of them made of rubber and half of iron



Hoist on skids is used to mount or dismount the attachments. Hand crank raises or lowers the sling

wheels out the husking unit and positions it under the hoist. Then by turning a crank he lifts the husker into the air and removes the carriage. He drives the three-wheeled tractor unit under the hoist, eases the husker down on top of it, slips retaining pins into place, installs the belt and drives out to the field. The whole process takes about 30 minutes. If he wishes to combine soybeans in the afternoon, he removes the husking unit and drops the harvester into position atop the tractor unit.

The basic tractor has two large drive wheels at the front, and is steered through the rear caster wheel which provides a short turning radius. The operator sits high

on the left side of the tractor—a vantage point which permits him to see the ground directly in front of the machine at all times. A four-cylinder V-type engine rated at 38 horsepower is cross-mounted behind him.

The machine becomes a nine-foot self-propelled combine when the harvesting unit is installed. A variable-speed drive enables the operator to change ground speeds without altering the threshing mechanism. The big grain bin can be unloaded with an auger as the harvester moves through the field.

When used in combination with a crop drier, the picker-sheller cuts the time required to harvest corn from weeks to days. The unit works efficiently in corn with up to 25-percent moisture content, making it possible for the operator to harvest his corn before it has been damaged by wind or borer, and while the ears are still moist enough to resist shelling.

Built into the picker-husker are four snapping rolls spaced to pick both the high and low ears. The 10 husking rolls (five made of rubber and five of iron) are 36 inches long. The snouts of the picker adjust to 5 floating positions.

Another attachment is the forage-crop implement with a floating-tooth roller for continuous crop feeding. The unit has a large blower and delivery pipe, and a ratchet clutch which prevents back-running of the roller when the feeding mechanism is reversed.

The attachments are designed to supplement each other, adding up to one machine that can handle all the crops across a big section of the country.

★ ★ ★



Cunningham's C-5R has the "impossible": 17-inch brakes on 16-inch wheels! It hit 152 m.p.h. at Le Mans

Cunningham Sets Record But Finishes Third in Le Mans Race

Britain and America took top honors in the 1953 Le Mans 24-hour race (see *PM*, June 1953, page 126). First place in the endurance competition went to a British Jaguar that traveled 2540 miles in 24 hours, averaging 106 miles per hour. The Jaguar broke by a substantial margin the record of 96 miles per hour set last year by Mercedes-Benz, which did not compete this year. Another Jaguar placed second. America came in third with the brand-new Cunningham C-5R, which the French nicknamed *Le Requin Souriant* (the smiling shark) because of its body and grille. The C-5R, driven by John Fitch and Phil Walters, averaged 104 miles per hour, traveling a total of 2498 miles. Two other Cunning-

hams were in the top ten. One placed seventh, the other tenth. Both were C-4R models, like those that raced in 1952. All three Cunninghams have Chrysler V8 engines with modifications that boost output to 310 horsepower. The C-5R was completed just in time for the race and had to be broken in on the drive from Cherbourg to Le Mans. It has torsion-bar nonindependent springing front and rear, a light low-slung chassis, improved steering and a more streamlined body than previous models. Eleventh place in the French classic went to another American entry, a Nash-Healey, which averaged 89.5 miles per hour for 2219 miles. The C-5R set a new record for one kilometer during the race—152.5 miles per hour.

Miniature Electric Mower Trims Hedges, Edges Lawn

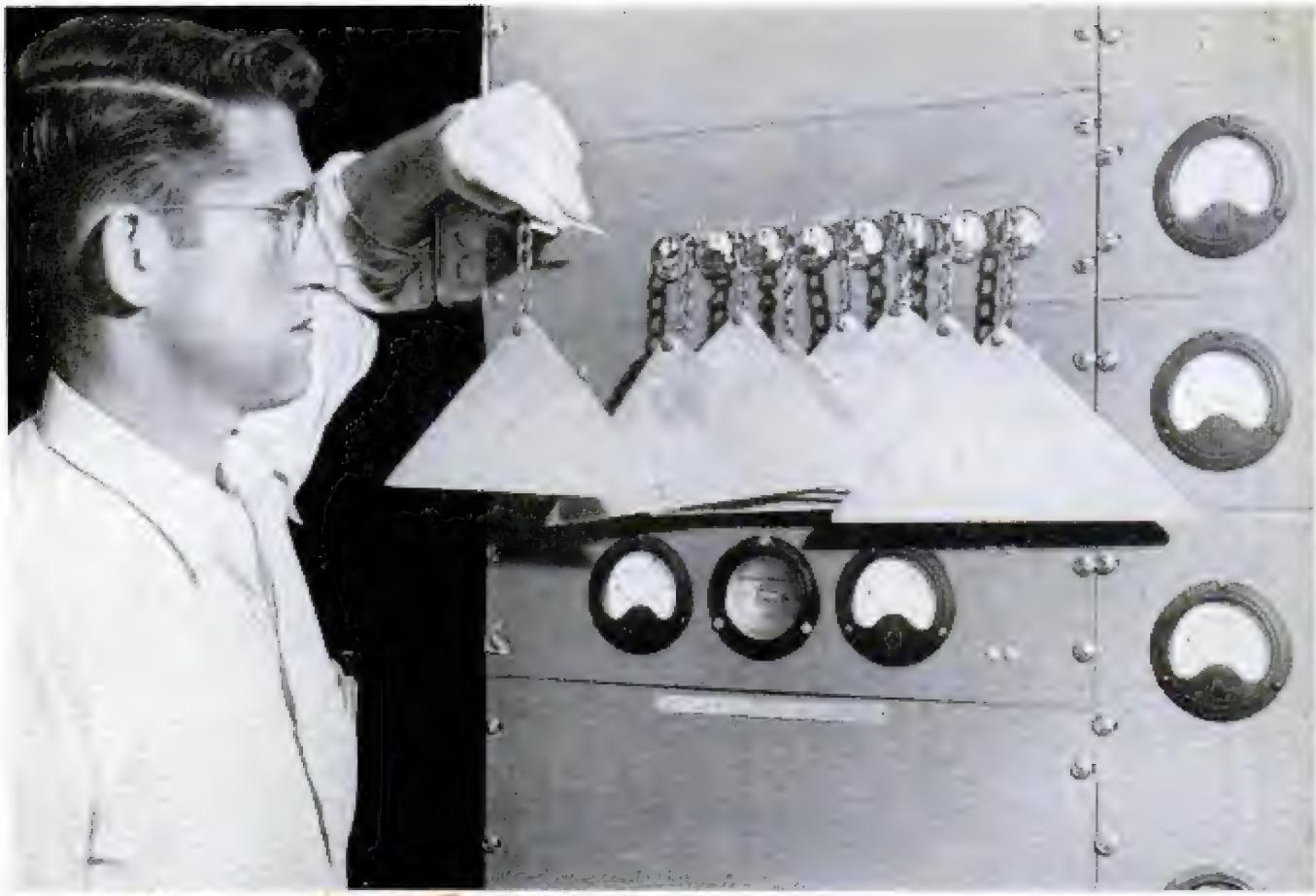
Weighing only three pounds, an aluminum electric mower can be used to trim hedges, prune small trees and shrubs, edge and trim lawns. It has an eight-inch blade that is whirled at 5000 revolutions per minute by a small electric motor. Its small size makes it ideal for trimming the lawn under fences and around shrubs.

Paper consumption in the United States has increased 61 percent in the last six years.

Around the Bend

What's ahead in railroad transportation? Four locomotive experts recently met in New York to answer this question in an exclusive *PM* panel interview. They discussed every type of locomotive power from the propane gas-turbine electric to atomic engines. Their answers—and predictions—will surprise you. Don't miss the experts' opinion on "What Comes After the Iron Horse?" In the next issue





Safeguards at Stanford's linear accelerator include eight doors into the "hot" area. Each door has a separate key. Doors must be locked, then all the keys inserted in a panel before the accelerator can be used

These Fabulous Tools

By Thomas E. Stimson, Jr.

THE RESEARCH TEAMS that discovered atomic energy are probing deeper into the heart of the atom today and there's a good chance that other exciting, though unpredictable, discoveries will be made.

Basically, the physicists are trying to find the true fundamental particles of which the atom (and hence the universe) is composed.

Once it was thought that the atom itself answered this definition; now it is known that the atom contains a bundle of assorted particles or bits of energy in its structure.

To learn the nature of these ultimate particles the physicists have built a whole new array of tools far more powerful than the cyclotrons of 10 years ago. Stanford's new linear accelerator, the University of Chicago's synchro-cyclotron, California Institute of Technology's electron synchrotron, the University of Illinois' betatron were all designed for this purpose.

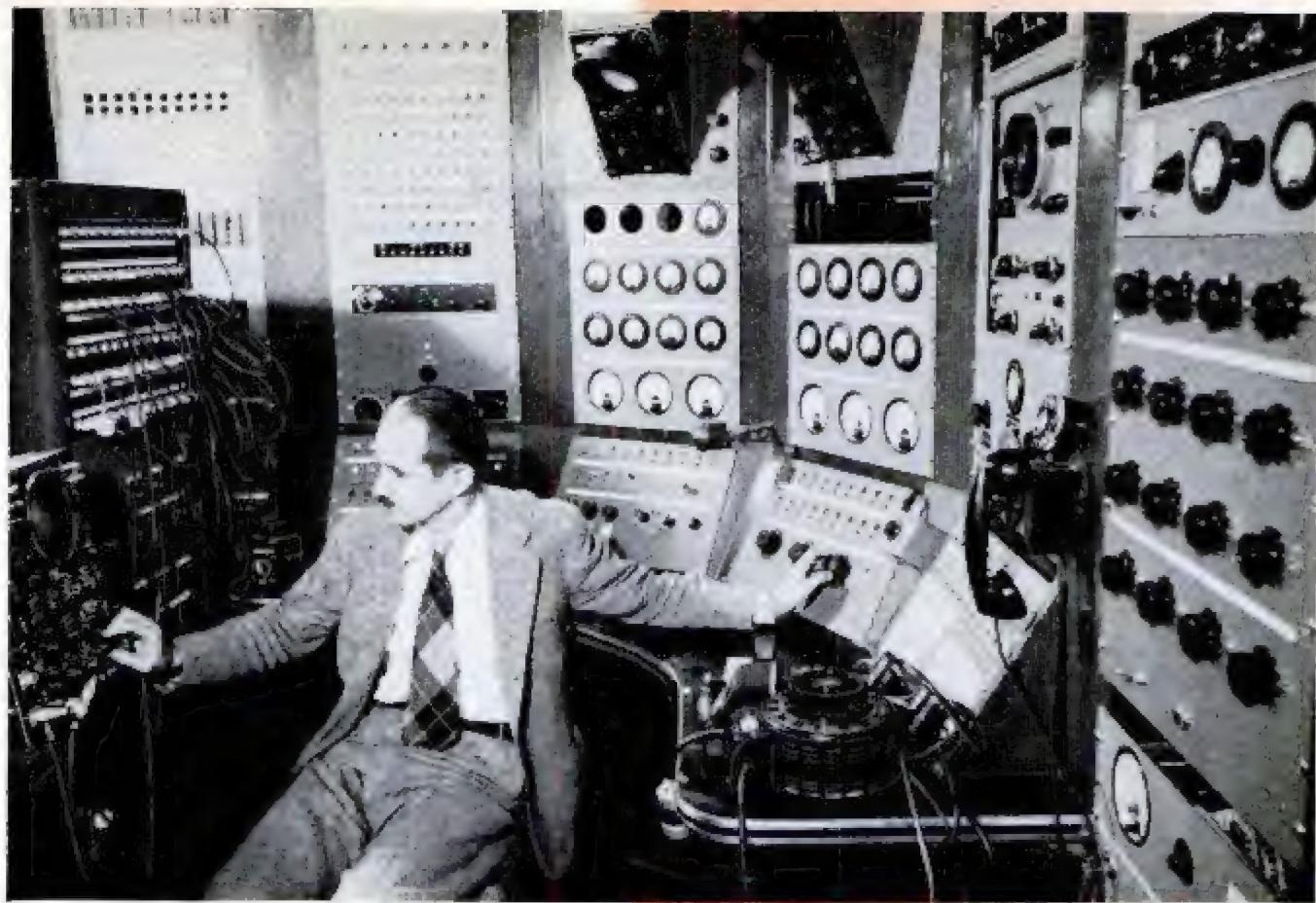
Most powerful of all is the enormous cosmotron at Brookhaven National Laboratory, now being tested at 2.3 bev (billion electron volts, the energy acquired by the particles it uses as bullets). Tremendous as it is, the cosmotron will be topped later

this year when the University of California completes its six-bev bevatron at Berkeley. And recently the Atomic Energy Commission announced plans for the most gigantic machine of all, a 100-bev strong-focus synchrotron for doing research on "new ways of releasing nuclear energy."

What are all these machines, anyway? What is a cosmotron? What's the difference between a synchrotron and a betatron? How does a linear accelerator compare with a cyclotron? Why so many different kinds?

To find out, *Popular Mechanics* questioned Prof. Edwin M. McMillan of the University of California's radiation laboratory. Professor McMillan is generally regarded as the "father" of most of the new huge accelerators because they were built to conform to the theory of "phase stability" which he and the Russian, V. Veksler, proposed independently. In particular, the synchrotron is a McMillan invention.

This theory makes it possible not only to double or triple the energy that can be imparted to electrons and other bullets, but to multiply the energy by any reasonable figure. Thus Berkeley's forthcoming beva-



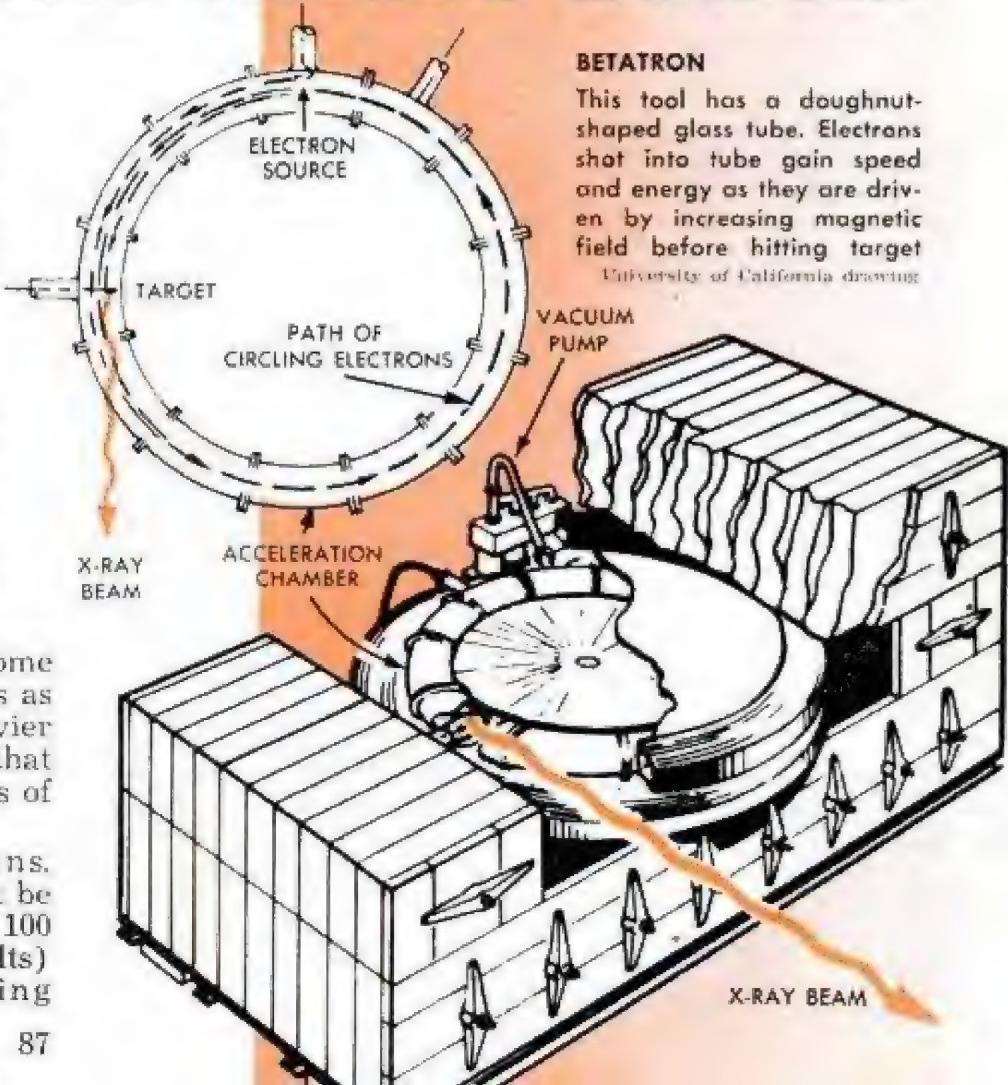
Professor McMillan operates the University of California's 300,000,000 electron-volt synchrotron from this elaborate control panel. He is regarded as the "father" of most of the huge new particle accelerators

Unlock the Atom's Secrets

tron will be able to accelerate protons to more than 60 times the highest energy that could be hoped for with one of the cyclotron designs of the 1930s. Professor McMillan is also one of the co-discoverers of plutonium and neptunium.

"To begin with," says Professor McMillan, "all the new machines have the same purpose. Each is a gun, or accelerator, designed to shoot atomic particles at the nuclei of atoms, at speeds just under the speed of light. Some of the guns use electrons as bullets, some use heavier particles such as protons that have 1836 times the mass of electrons."

In prewar cyclotrons, heavy particles could not be accelerated much above 100 mev (million electron volts) because the increasing



BETATRON

This tool has a doughnut-shaped glass tube. Electrons shot into tube gain speed and energy as they are driven by increasing magnetic field before hitting target

University of California drawing

TOOLS OF THE NUCLEAR PHYSICIST

| Type | Location | Particle Energy |
|--------------------------------|------------------------------------|--|
| Electrostatic generator | Many in existence | |
| Betatron | University of Illinois | 300 mev* |
| Electron linear accelerator | Stanford University | 1-bev** design, now operating at 300 mev |
| Proton linear accelerator | University of California | 32 mev |
| Synchro-cyclotron | University of Chicago | 450 mev |
| Electron synchrotron | California Institute of Technology | 1-bev design, now operating at 500 mev |
| Proton synchrotron (cosmotron) | Brookhaven National Laboratory | 2.3 bev |
| Proton synchrotron (bevatron) | University of California | 6-bev design (under construction) |
| Strong-focus synchrotron | Atomic Energy Commission | 100 bev (proposed) |

*Million electron volts

**Billion electron volts

weight of the particles (a particle gains mass as it gains energy, according to the law of relativity) caused them to lag behind and fall out of step with the regularly spaced electrical pushes.

The cyclotrons were powerful enough to alter the nuclei of atoms and permit transmutations of matter and the discovery of new elements. But they were not strong enough to split particles of the nucleus into smaller components, or to create the mesons that have been regarded as the nuclear "glue."

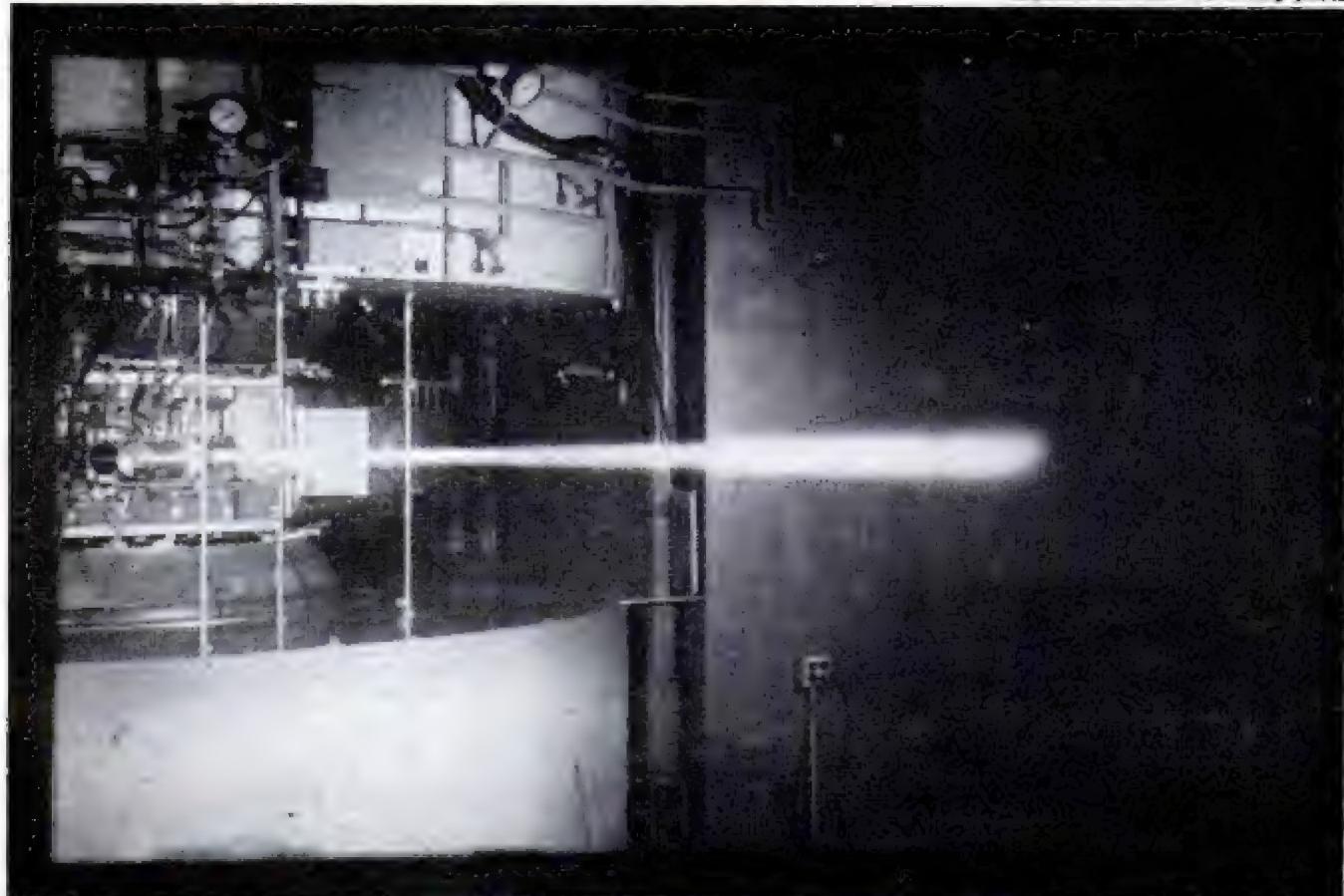
With phase stability all this is now possible. Professor McMillan's idea was to syn-

chronize the accelerating device with the particles. The machine would remain in step with the particles either by varying the magnetic field or retiming the energy pulses, or both.

In the case of the 184-inch cyclotron that was under construction at Berkeley at the time, changes were made (by retiming the energy pulses) permitting it to keep step with the particles it was accelerating. As a synchro-cyclotron, the machine has a power of 350 mev, over twice its original-design power.

The synchrotron, in which McMillan's theory is applied by varying the magnetic

Beam of deuterons flashes out of 60-inch cyclotron. It was photographed through a window seven feet thick
 Argonne National Laboratory photo



field, is essentially a machine for accelerating electrons. With various changes, however, it can be used to accelerate protons and other heavy particles. A synchrotron consists of a large doughnut-shaped vacuum chamber contained in a magnetic field. The machine is operated first as a betatron or induction accelerator and then, as the electrons begin to lag, the machine is operated as a synchrotron. Electromagnetic force is built up in the magnet units to jerk the electrons around to the gap at which they receive their next charge from a high-frequency oscillator.

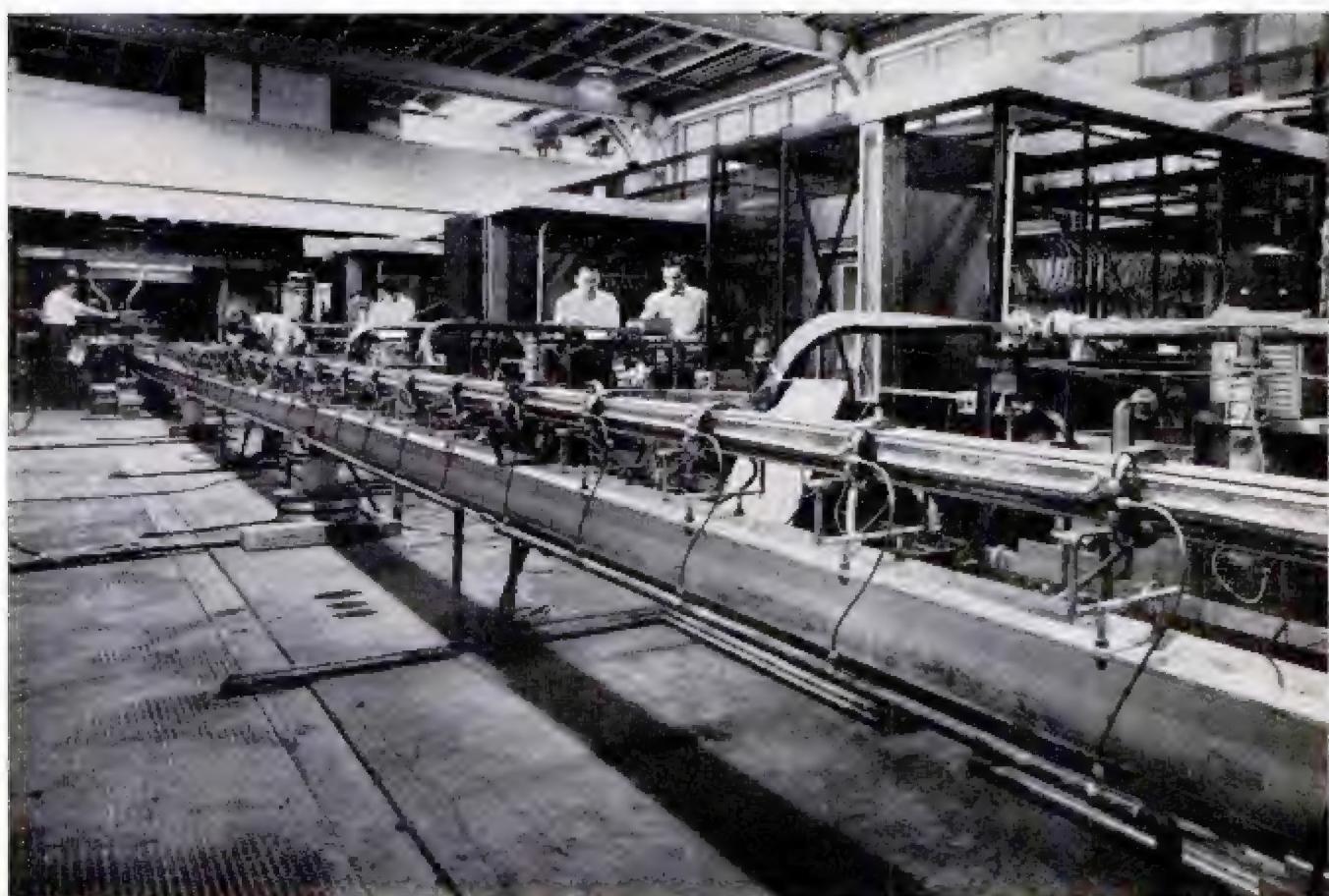
The cosmotron and the bevatron are simply "local" names (used at Brookhaven and Berkeley respectively) for huge synchrotrons designed to accelerate protons as bullets. When completed, the bevatron will have a magnet weighing about 10,000 tons with a diameter of 110 feet. It will represent an investment of nearly \$10,000,000.

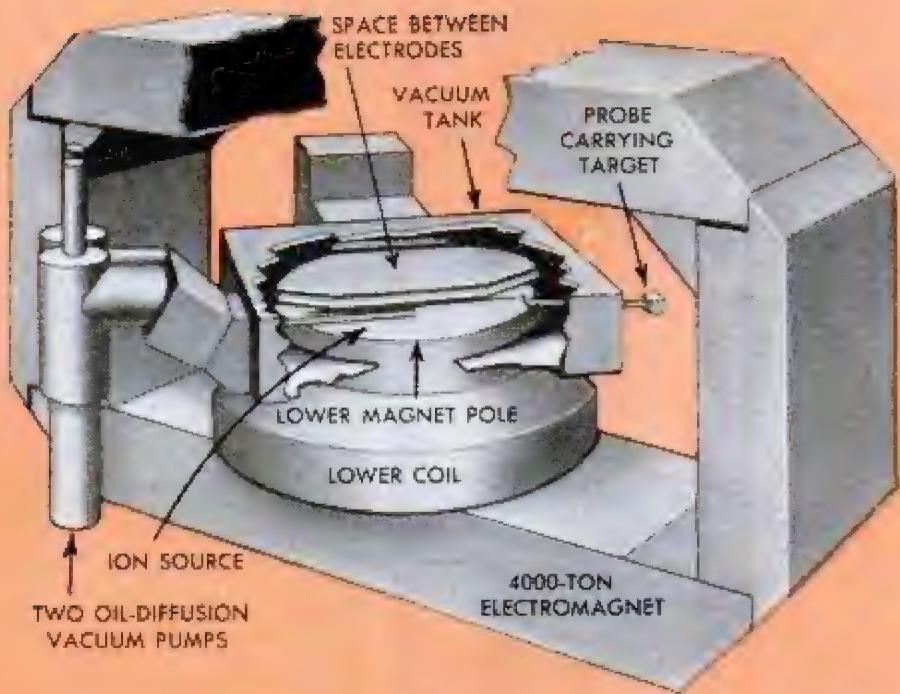
Linear accelerators do the same job as the circular accelerators and their energy depends upon the length of their tubes, among other things. Biggest to date is the one-bev electron linear accelerator (now being tested at partial power) at Stanford University.

This machine has a 200-foot-long vacuum tube that eventually will be extended another 20 feet. Electrons are accelerated to increasingly higher speeds as they move down the tube by impulses of radio frequency energy provided by klystron power tubes spaced at 10-foot intervals along the



Research photo shows spiral path of meson shot from accelerator. Below, linear accelerator is an "atomic rifle" that speeds particles along a straight path
University of California Radiation Laboratory photo

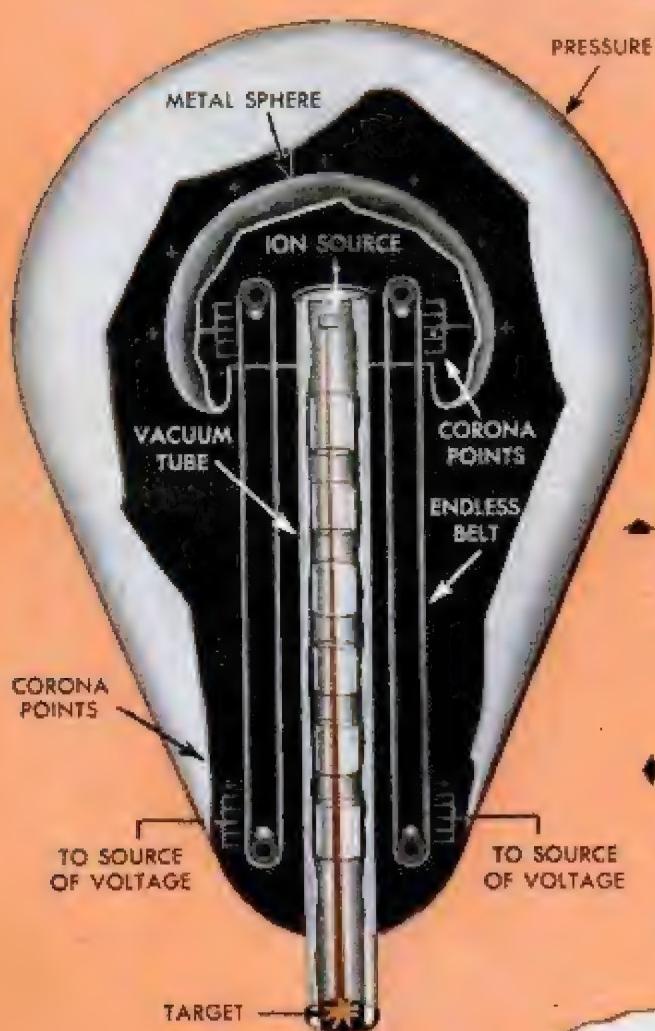




SYNCHRO-CYCLOTRON

When a particle reaches high energy in conventional cyclotron it also gains weight and falls behind the regular timed pushes. In synchro-cyclotron, pushes are slowed down so they are synchronized with speed of lagging particles. This produces a beam of particles of greater energy

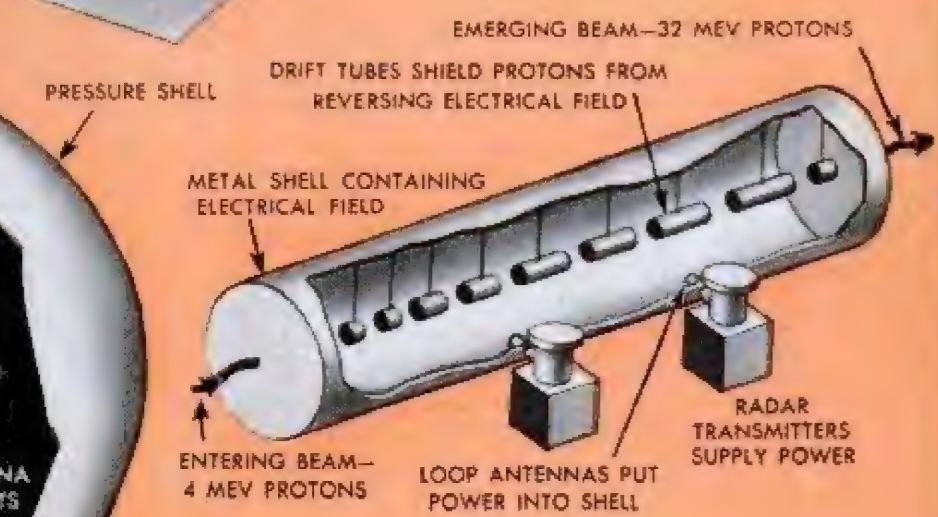
University of California drawing



SYNCHROTRON

This machine accelerates electrons inside a circular glass tube placed in the field of a magnet. The magnet accelerates electrons to nearly the speed of light. Then they are given a slightly greater velocity by an accelerating electrode, and increase tremendously in mass and energy

Westinghouse drawing



LINEAR ACCELERATOR

Radar transmitters broadcast a high-frequency electrical field into a cylinder. This alternating field accelerates the protons between drift tubes. Function of tubes is to shield protons from reversing field

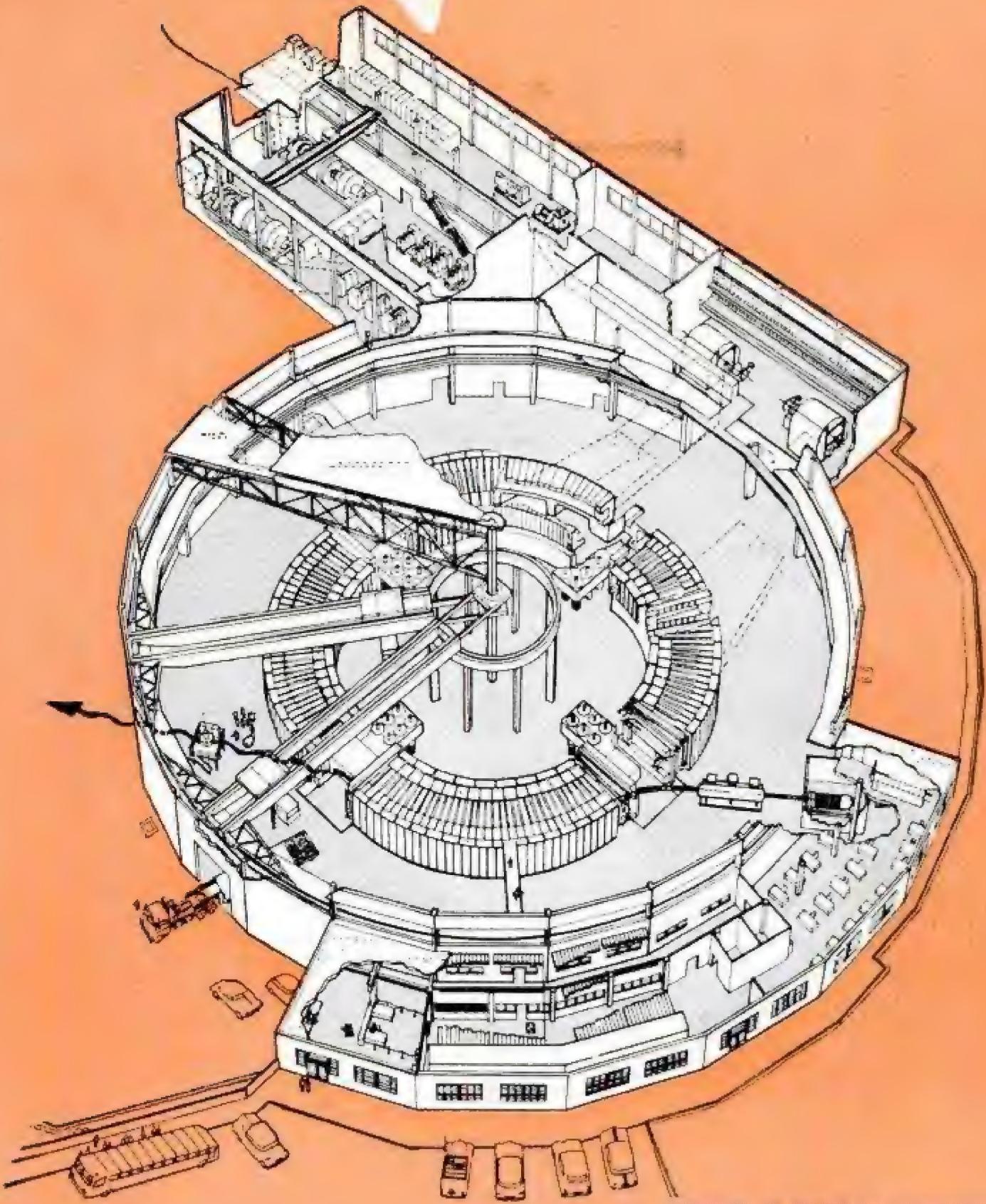
University of California drawing

VAN DE GRAAFF GENERATOR

This instrument has endless belts which become positively charged as electrons are drawn off by a positive potential. The belts then draw more electrons from a metal sphere. As the sphere is brought to a high potential, it is used to speed particles through a vacuum tube

Westinghouse drawing





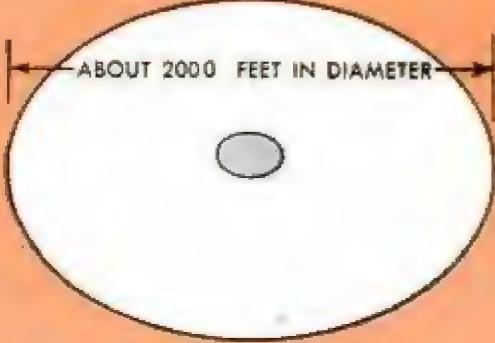
PROPOSED STRONG-FOCUS SYNCHROTRON
(BEVATRON)

BEVATRON

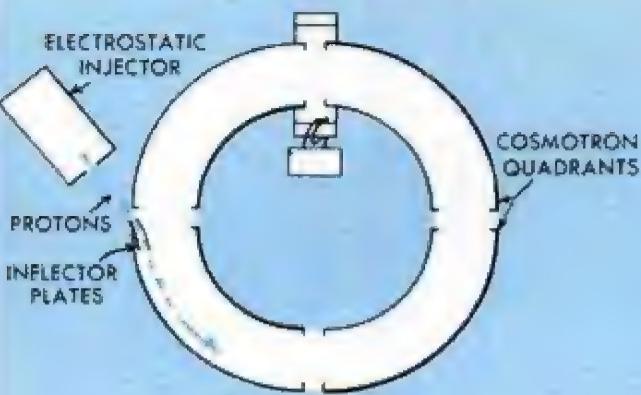
This huge accelerator, when completed, will be an immense proton synchrotron with extremely high energy. The magnet will be ring-shaped and will weigh about 10,000 tons. It will have a diameter of 110 feet. It is designed to accelerate particles to several billion electron volts, permitting experiments never before attempted. An even larger bevatron, called a strong-focus synchrotron, has been announced by the Atomic Energy Commission. It is estimated that the magnet and tube will be more than 2000 feet in diameter, and it may accelerate particles, through strong focus, to 100,000,000,000 electron volts.

University of California drawing

MAY ACCELERATE PARTICLES TO 100 BEV

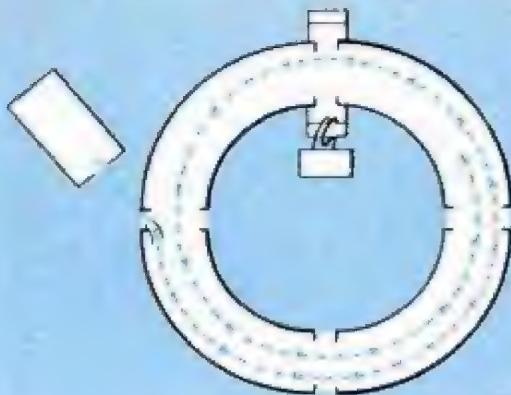


1. INJECTION OF PROTONS



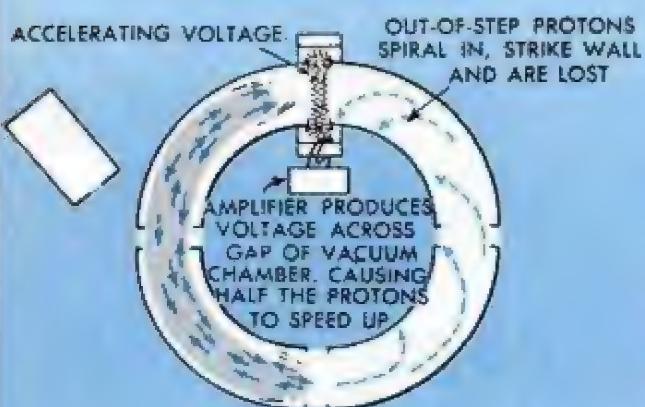
Protons from an electrostatic generator are shot into the metal vacuum tank of the cosmotron at an energy of 3,600,000 electron volts

2. REVOLUTION IN MAGNETIC FIELD



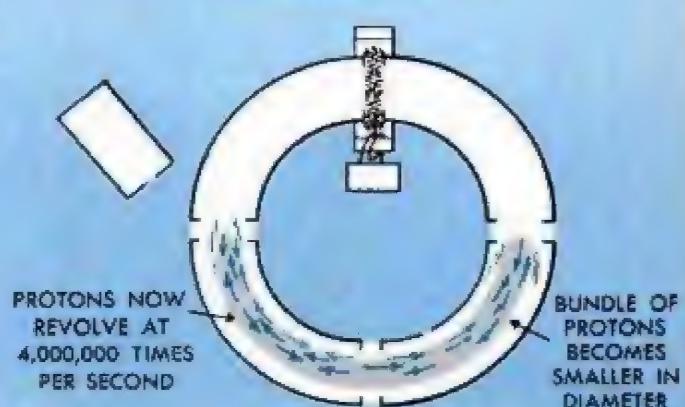
Increasing magnetic field in the vacuum tank causes protons to spiral in around the cosmotron. They make 350,000 revolutions per second

3. ALTERNATING VOLTAGE TURNED ON TO ACCELERATE SOME PROTONS



Protons that have been speeded up stop spiraling, group together in a sausage-shaped bundle and continue to revolve at higher and higher speeds

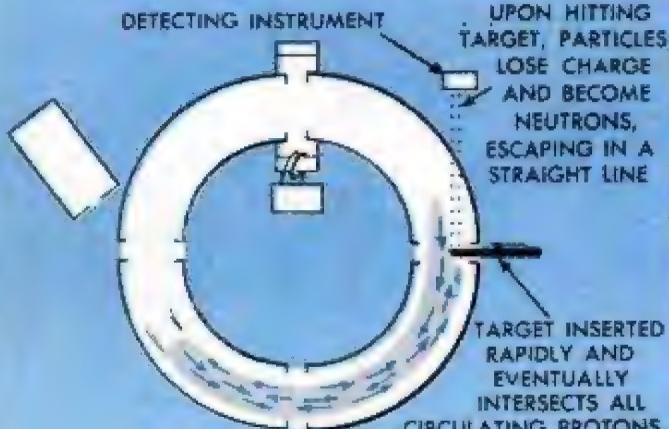
4. PROTONS ACCELERATED TO 175,000 MILES PER SECOND



Each passage through accelerating voltage adds 800 electron volts. After 3,000,000 turns, protons acquire energy of 2,300,000,000 electron volts

Atomic Energy Commission drawings

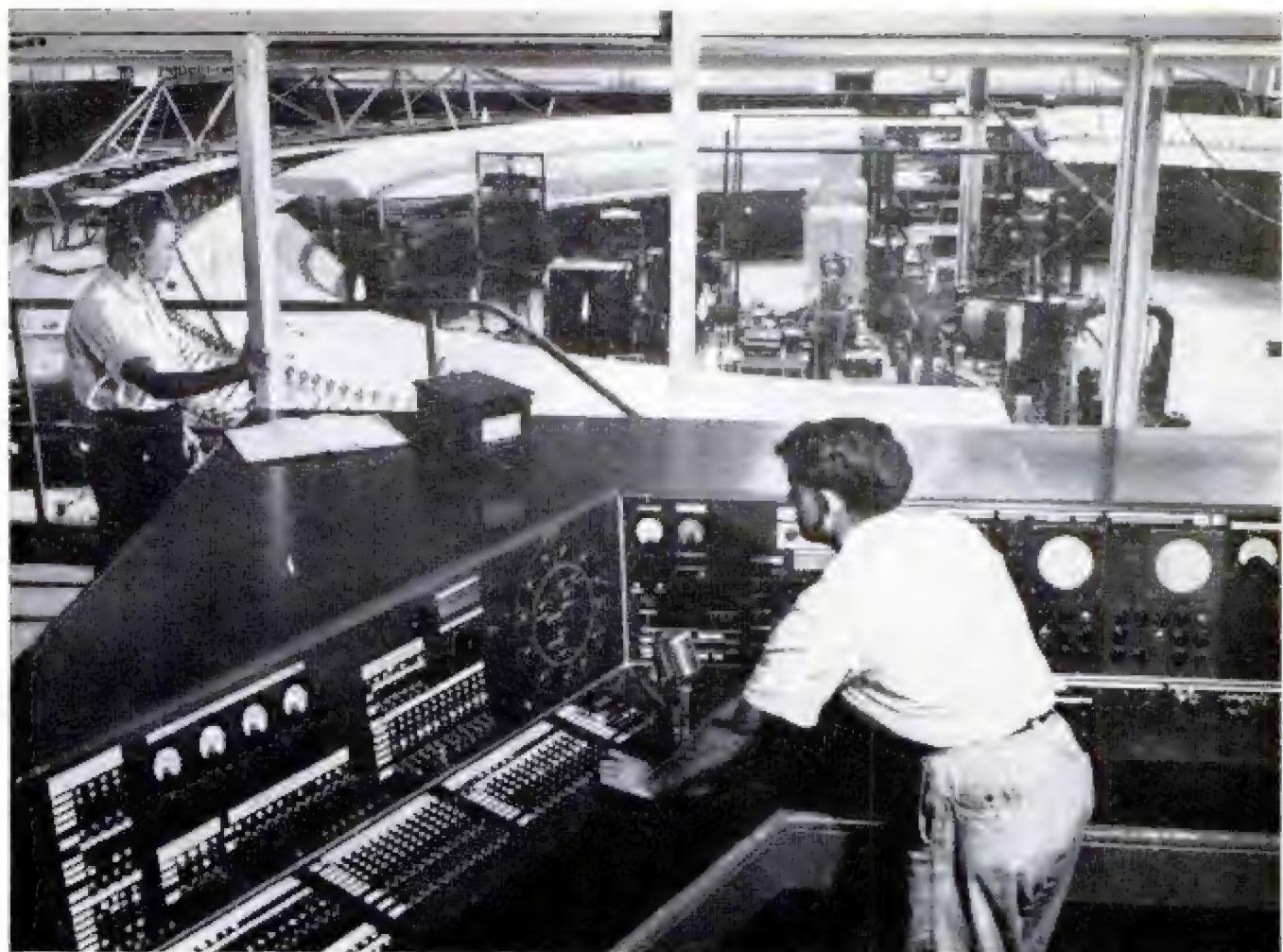
5. TARGET INSERTED IN PATH OF PROTONS



Detecting instruments such as cloud chambers are used by scientists to study results of the collision of the particles with various elements

THE COSMOTRON

| | |
|----------------------------|-------------------|
| The proton beam | |
| Energy of protons | 2.3 bev |
| Number of revolutions | |
| to full energy | 3,000,000 |
| Distance travelled | |
| by protons | 130,000 miles |
| The magnet | |
| Radius | 30 feet |
| Weight of magnet | 1800 tons |
| Maximum power supplied | |
| to magnet | 40,000 horsepower |
| The injection system | |
| Energy of injected protons | 3.6 mev |
| Number of injected protons | 1 trillion |



Operator in the control room can see the cosmotron through a glass wall. The huge magnet is covered with a plastic "cocoon"

Protons shoot into cosmotron through equipment at lower left. Magnet forces them in circle so they can be given higher energy

Brookhaven National Laboratory photos



line. Each tube delivers more than 15,000,000 watts at full power and if they could be operated constantly instead of in millionth-second flashes, 20 of them could light a city the size of San Francisco.

The University of Minnesota, meanwhile, is testing a new proton linear accelerator that has a design power of 68 mev.

There are probably 100 accelerators the world over being used for nuclear research and in addition there are several being used for nuclear research and in treating deep-seated cancer. Acceleration machines are ideal sources for producing high-energy X rays.

Conventional X-ray equipment is adequate for treating cancer at or just below the skin but may cause X-ray sickness and burns when used for deeper penetration. The high-energy X rays, on the other hand, apparently can reach cancerous growths within the body without injury to overlying tissues.

Most powerful of the medical accelerators is a 70-mev synchrotron at the University of California's School of Medicine in San Francisco. Next is the 20-mev betatron

(Continued to page 216)



Folded into a compact package for road travel, the trailer follows easily behind car, doesn't obscure vision

Tent on Wheels Adds Comfort to Camping

YOU CAN "rough it" in comfort on your next hunting or fishing trip with a new tent-trailer that is lightweight and no problem in traffic, but is a boon in the wilderness. Less than four feet high when it's trailing behind the car, the unit forms a roomy shelter when it is erected for camping. It takes one man only 20 minutes to erect the frame and stretch the canvas. Roomy storage boxes on each side hold tent and cargo. In the front end is room for a sink, stove, icebox and food storage. The unit comes ready-made or in knockdown form with prefabricated parts.

It takes only 20 minutes of light work to set up trailer for camping. Frame is of marine fir plywood

Kitchen equipment doesn't need to be relocated for cooking. There's room for a stove, icebox, sink, storage



In extended position, the trailer is 7½ feet high in the center, 10 feet long and 12½ feet wide. Screens cover the side openings



Incinerator Uses Wastepaper as Fuel to Burn Wet Garbage

No outside source of fuel is required in a new incinerator that burns trash and wet garbage. The garbage is placed in a slanted bin above the paper and other combustible materials. When ignited, air is drawn into a preheater area. The air then moves up through the burning trash where it gains such a high heat level that it burns the wet garbage. Within 15 minutes, nothing is left but a residue of ash. The incinerator has a capacity of five bushels and ashes need be removed only once in every two-month period.



Apartment-Size Washing Machine

So small it can be used as a kitchen utility table, a new washing machine is designed primarily for use in small homes and apartments. Only 16½ by 17½ inches at the base, it will wash six pounds of clothing in four minutes according to the manufacturer. The hand-operated wringer swings down into the machine when not in use and the cover becomes the tabletop. Instead of an agitator, the machine has a small whirling disk that swirls the water, turning the clothes in all directions.



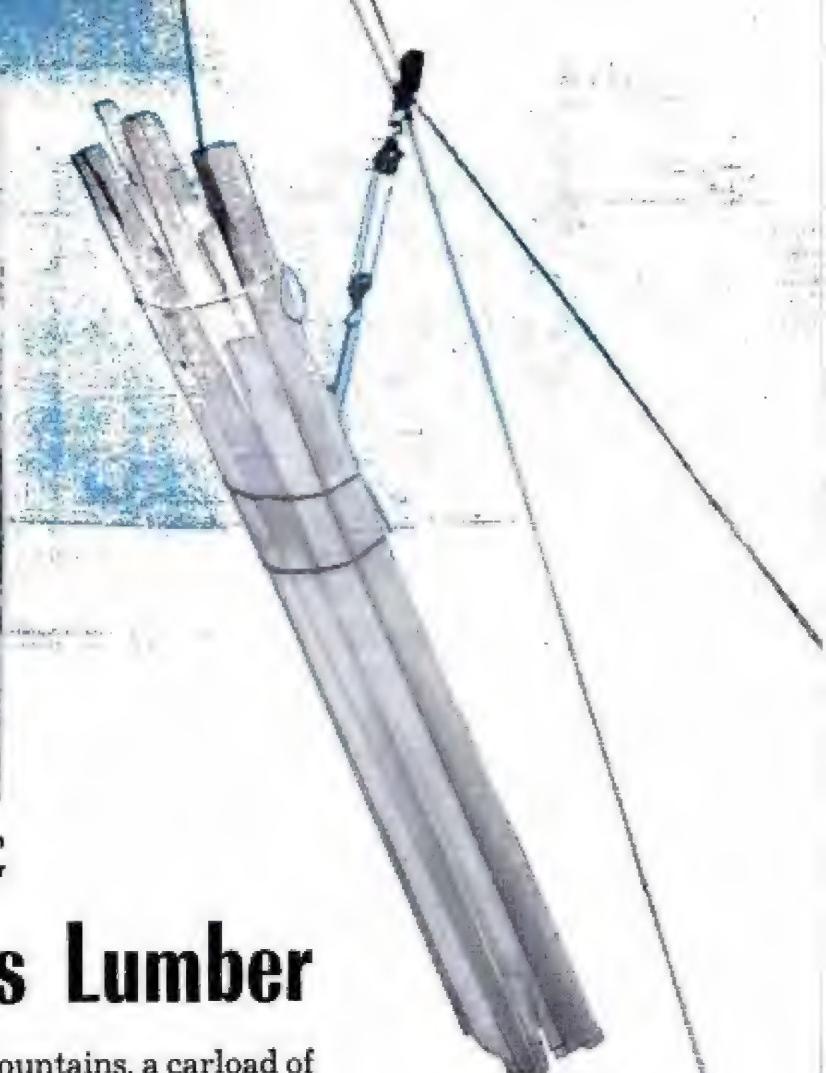
Fisherman Is His Own "Motorboat"

Now the fisherman, comfortably perched on a canvas seat inside an inner tube, can float around a pond, river or lake, propelling himself with kicks of his feet. The angler straps hinged paddles to the heels of his shoes. With each backstroke of his leg, the paddle flips out and moves the fisherman forward. On the return stroke the paddle folds flat for less resistance against the water. A truck inner tube is covered with a canvas jacket, with the adjustable seat strapped to the jacket. The inner-tube cover also has a pouch for carrying bait or extra tackle.





Waiting truck receives first load of lumber from freight car in ravine. Another truck supplied power



"Ski Tow" Salvages Lumber

DERAILED IN New Hampshire's White Mountains, a carload of valuable timber went tumbling 500 feet down a ravine. A bid of \$800 won possession for the State Park Service, which strung a 300-foot line of reserve ski-tow cable down to the car from a near-by highway. Using a tree at the wreck scene, and a "dead man" post back up on the road, they rigged up their carrier. Loads of lumber were hoisted by pulley operated by a truck running back and forth on the highway. Result: The state got \$5600 worth of lumber for its \$800 bid and the \$350 salvage cost.

At anchor tree, lumber is bundled and attached to carrier which takes it for "ski tow" ride up the hill

Salvage operations begin. Though its 500-foot roll down ravine smashed car, lumber was little damaged





Group race brings out yachtsmen and boats of all classes. Hundreds of dollars are invested in some models

MIDGET YACHTS RACE FOR FUN

By Ewart Thomas

WHEN THE BREEZE springs up on a Sunday afternoon at Alondra Park pond near Los Angeles, the powerboat enthusiasts carry their models ashore and the real wind sailors take over.

Within minutes a half dozen sailing yachts are heading out across the water, fighting for the lead in the day's first race. Juvenile toys? No. The boats are finely made, delicately balanced and highly tuned miniature racing craft.

A typical model yacht of the X class may weigh 25 pounds and have a length of 74 inches. Its streamlined mast is about 76 inches tall, with stainless-steel dental-wire rigging and with 1000 square inches of balloon-cloth sail. The hull usually is double-planked of red cedar and mahogany, or it may be built up from layers of glass fibers and plastic. On deck is a complicated array of gear which controls the rudder and sails.

Sometimes it takes more brains to win a

Owner adjusts rig of an X-class boat, which is 75 inches long and has 1000 square inches of sail area





Model yachtsman adjusts radio receiver in schooner. He can control sails or auxiliary motor from shore

model-yacht race than it does to jockey a full-size boat to first place. A model-yacht skipper can't continually trim his sails to compensate for changes in wind. He must make the adjustments ahead of time that he believes will give him the best speed for the course. His boat is on its own as soon as the race starts.

Competing at Alondra Park you'll find such enthusiasts as Mel Heflinger, United Air Lines captain; Louis Bourgeois, who is an aircraft-engine patternmaker, and Art

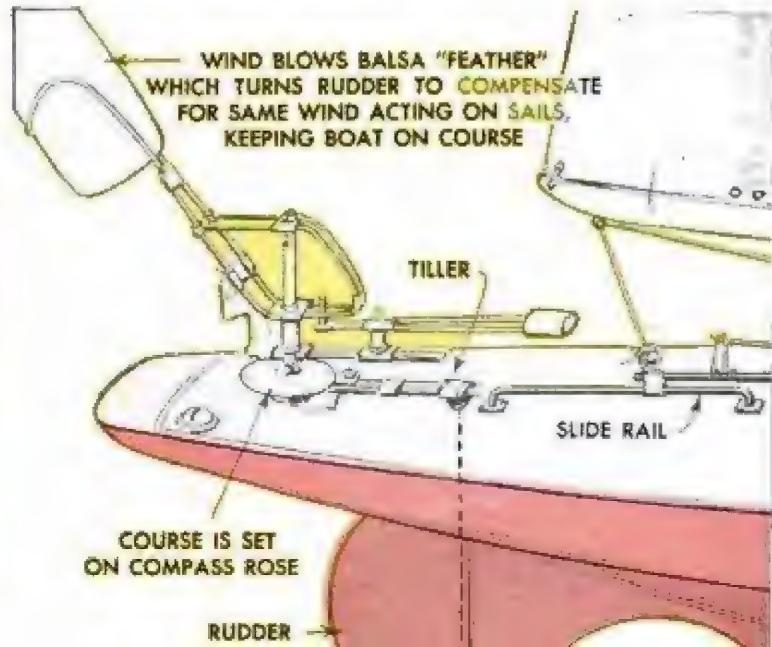
Keels are made of lead. At right is a conventional fin keel, at left a fast, experimental "seal flipper"



Weyman, district manager for the firm operating the spectacular trucks that snuff out airport fires with enormous blasts of carbon dioxide.

To show how the sailing bug can get you, there's the case of Irwin Ohlsson of Ohlsson & Rice, manufacturers of the little gas engines used on model aircraft, cars and powerboats. Powered models are a business with Ohlsson; for recreation he races his model sailboat.

Several centuries ago British admirals were racing small models of the fastest ships under their command. Shortly after





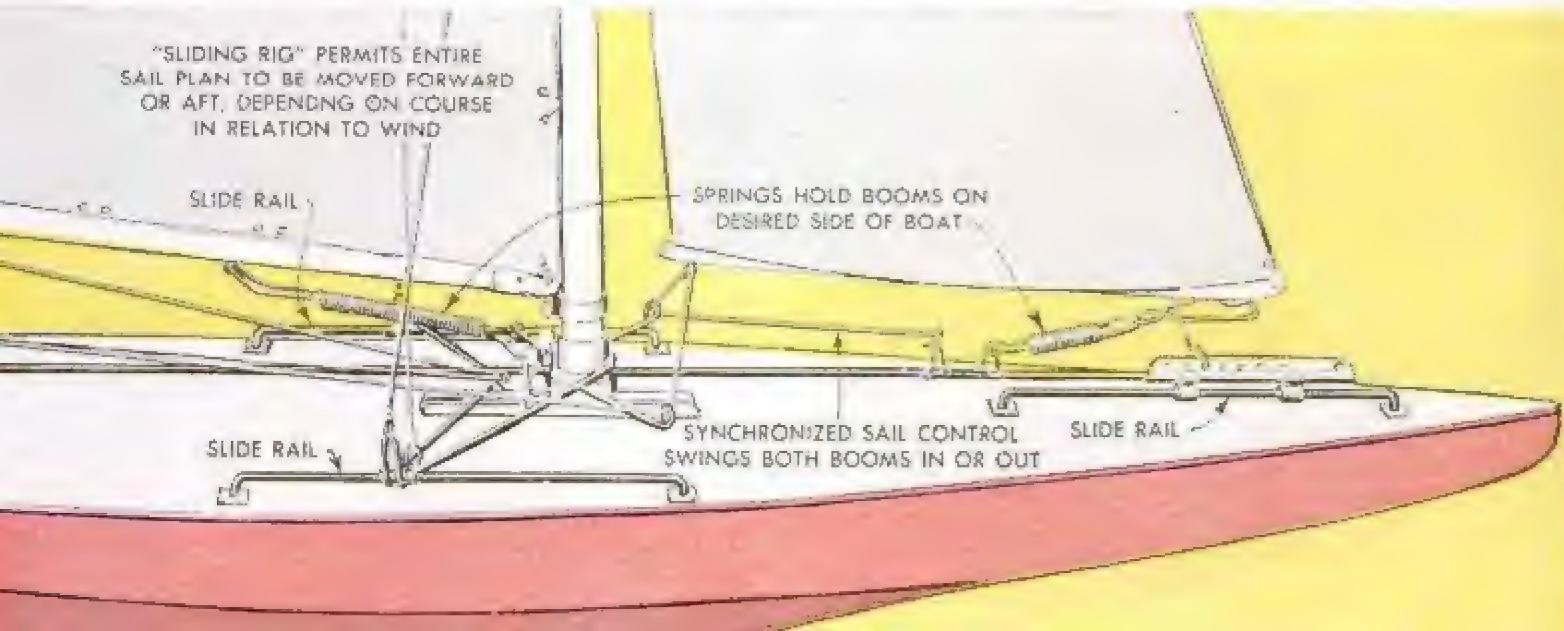
"Gus" Lassal, inventor of the sliding rig which moves entire sail plan, explains mechanism to new boat owner

the Civil War the racing of model sailing craft was a popular hobby on Long Island. In the '80s there were clubs in Brooklyn and Marblehead, among other places.

Today there are some 20 model-sailing clubs affiliated with the Model Yacht Racing Association of America. The sport is even more popular in Europe. Models can be sailed on any suitable water, a preferred course being 800 feet long and about 250 feet wide. Races are always in two heats, from one end of the course to the other and return. Long-distance races of up to two miles are sometimes held on large lakes,

and there's talk of a real ocean race soon between Catalina Island and Newport on the California coast, a distance of about 40 miles.

In the old days the model boats aped the enormous sail areas that were used on full-size vessels. Many a model yacht staggered along under a vast jib that extended out to the end of a bowsprit, and a huge gaff-headed mainsail. Today's boats have been refined and cut down in keeping with modern design and, as a result, are exceedingly fast. Some of them have been logged at six knots, a scale speed that is away out





Lassal works on an experimental "finless fin" keel which improves sailing characteristics, making boat faster

of proportion to the size of these models.

Spark plug of the Los Angeles Model Yacht Club is A. R. "Gus" Lassal, a 70-year-old model builder who builds beautiful racing craft for purchasers in many parts of the country. Lassal sailed his first models when he was a boy in Finland before coming to the United States. In 1934 he plunged seriously into the sport when he built a number of M-class models from a set of plans that had been published in *Popular Mechanics*.

Lassal invented the sliding rig, now used

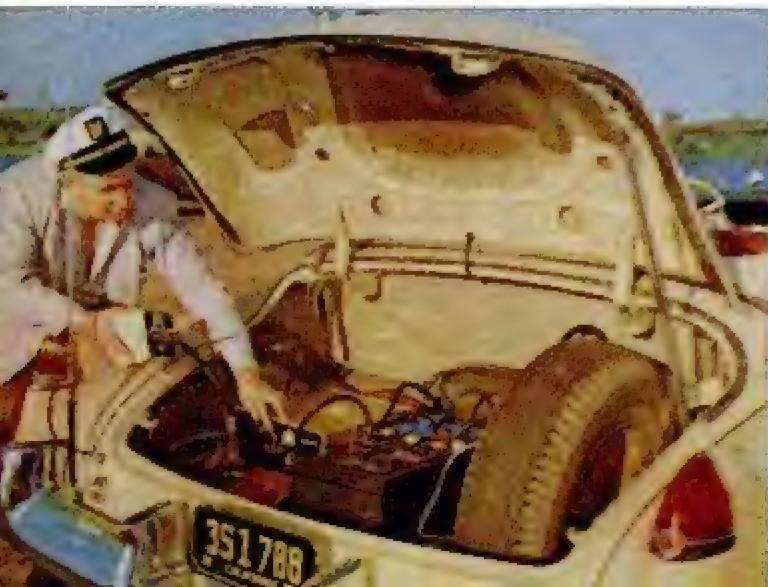
Radio transmitter in trunk of car, operated on batteries, can control model yacht many miles away

almost universally on model racing craft, and he had much to do with the perfection of vane steering by which a model holds a desired course in spite of shifting winds. These two innovations have put model sailing on a practical, virtually scientific basis.

The sliding rig can be traced right back to "Zip," the 50-incher that *Popular Mechanics* described. Previously it had been customary to step the mast in one of a series of holes bored in the deck—in a forward hole when the wind is light and in a hole

(Continued to page 210)

✓ JUNE 34 p. 126 B&W photo -
Precisely controlled by preset sails and its balsa
"feather," model sails across pond to waiting owner





Taking the place of a wheelbarrow, above, the little tractor tows a cart full of tools down a garden walk. Width is 28½ inches. At right, it mounts a 10-inch circular saw and table



This isn't a gag shot. There's enough power in the midget to pull an automobile up a slight grade. Below, Hiller mows his lawn in comfort, towing a 20-inch mower and grass catcher. Fuel consumption for most yard work is one quart per hour

Tiny Garden Tractor Carries Operator

WHEN Stanley Hiller, Jr., of Hiller Helicopters, found he didn't have enough time to take care of his lawn he designed a tiny low-cost riding tractor to help do his chores. Now on the market, his "mechanical yard hand" is powerful enough to carry a full-grown person and tow a mower, cultivator, heavy lawn roller or other implement. A 1½-horsepower two-cycle engine, which has a 40-to-1 reduction friction-belt assembly, permits towing a mower up a 26-percent grade with power to spare. The unit has two forward speeds with a top speed of four miles per hour, uses a recoil starter and has ratchet-type clutches to permit pivoting on either rear wheel.

Gear speed is changed by shifting friction belts. Lever shifts from neutral to drive



The OWNERS

KNOXVILLE, TENN., PHYSICIST

POPULAR MECHANICS OWNERS POLL
CONDUCTED BY FLOYD CLUMER

1. I am a 1953 Packard Clipper X Clipper Deluxe Custom Cavalier, Mayfair, Convertible. 5926
Patricia Overdrive Ultramatic drive

2. It has conventional transmission premium (high test) gasoline Cavalier, Mayfair, Convertible. 5926
3. I use regular gasoline 13 m.p.g. in country 16.5 m.p.g.
4. Average gasoline mileage in city I change oil every 3000 miles.
5. I add NO quarts of oil in 1000 miles. Good Unsatisfactory
6. Roadability * Excellent Good Unsatisfactory
7. Handling * Excellent Good Unsatisfactory
8. Structural rigidity * Excellent Good Unsatisfactory
9. Acceleration from a standstill from 30 miles per hour Excellent Good Unsatisfactory
10. My reasons for buying a Packard are: *Classic exterior lines and finish, and trade-in allowance on my former car*
an excellent trade-in allowance on my former car
11. If you own a Packard power steering is Yes No
12. If you own a Packard power steering is Yes No *Power steering is necessary*

* FROM THE EXPLANATION OF THESE TERMS SEE OTHER SIDE OF SHEET

ULTRAMATIC MODELS USED MORE GAS THAN THIS OVERDRIVE CLIPPER

STYLING AND TRADE-IN ALLOWANCE WERE POPULAR REASONS FOR BUYING

53% THINK POWER STEERING WORTH ITS COST

11. If you own or have tried Packard power steering do you feel it is worth the extra cost? Yes No *Power steering is necessary*
- Comments: *Packard steering is quite effective, feel power steering necessary*
12. If you own Packard power brakes, check your opinion of them. Good Fair Poor *Power steering is necessary*
13. Would you prefer a V8 engine to the straight 8? Yes No *No particular preference*
14. Rate these points:
- | | | | |
|-----------------------|--|-------------------------------------|----------------------------------|
| Visibility, forward: | Like <input checked="" type="checkbox"/> | Acceptable <input type="checkbox"/> | Dislike <input type="checkbox"/> |
| Visibility, rear | Like <input checked="" type="checkbox"/> | Acceptable <input type="checkbox"/> | Dislike <input type="checkbox"/> |
| Riding qualities. | Like <input checked="" type="checkbox"/> | Acceptable <input type="checkbox"/> | Dislike <input type="checkbox"/> |
| Horsepower output. | Like <input checked="" type="checkbox"/> | Acceptable <input type="checkbox"/> | Dislike <input type="checkbox"/> |
| Exterior body styling | Like <input checked="" type="checkbox"/> | Acceptable <input type="checkbox"/> | Dislike <input type="checkbox"/> |
| Interior body styling | Like <input checked="" type="checkbox"/> | Acceptable <input type="checkbox"/> | Dislike <input type="checkbox"/> |
| Length of wheelbase: | Like <input checked="" type="checkbox"/> | Acceptable <input type="checkbox"/> | Dislike <input type="checkbox"/> |
| Engine noise | Like <input checked="" type="checkbox"/> | Acceptable <input type="checkbox"/> | Dislike <input type="checkbox"/> |
15. Specifically, what are your complaints from roof and rain come in front window. Difficult to clean wing-like floor mats. Sluggish starting from a standstill.
- Comments: *Gas mileage not too good. Dislike way water*
16. If you own a Packard Yes No *Gas mileage not too good. Dislike way water*

ASTORIA, ORE., SALESMAN

POOR GAS ECONOMY AND WATER LEAKS WERE TWO MOST FREQUENT COMPLAINTS 59% ARE PREVIOUS OWNERS

16. Have you ever owned a Packard before? Yes No *How many? SIX*
17. Would you buy another Packard? Yes Possibly No
18. How is your dealer service? Excellent Good Average Poor
19. An over-all rating of your Packard Excellent Good Average Poor
- Comments: *No additional comments here*

POWER BRAKES - I BELIEVE THERE SHOULD BE AN ADDITIONAL BRAKE TANK JUST IN CASE YOUR MOTOR STALLS WHEN THE BRAKES ARE HEAVILY APPLIED IN AN EMERGENCY.

ULTRAMATIC IS DESIRABLE BUT IT'S THE SAME STORY AS ANY OTHER AUTOMATIC TRANSMISSION - GELS CONSUMPTION IN CITY DRIVING

HOWEVER, I BELIEVE PACKARD'S TRANSMISSION IS THE FINEST OF A NEW YORK RESTAURANT MAN

64% OF OWNERS RATE PACKARD EXCELLENT

REPORT on the '53 PACKARD

By Floyd Clymer

WE TOOK PACKARD at its word. For years the Packard people have been advising the motoring public to "ask the man who owns one." So we did. Popular Mechanics asked 1000 owners of 1953 Packards to rate their cars.

The replies show that 64 percent rate them excellent—the largest percentage of excellent given any 1953 car surveyed thus far.

Packard has a new top management and is out for sales with vigor. It is making a bid in the medium-price field with its Clipper and Clipper Deluxe, the models driven by 78 percent of the owners replying to our questionnaires. In the luxury field, Packard is out to regain the prestige it lost when it brought out a less-expensive line during the depression years.

Here are some reasons why Packard owners rate their cars highly:

"Roomy and comfortable . . . Chair-high seats are a pleasure."—Owensboro, Ky., merchant.

"Trouble-free miles."—Tulsa, Okla., dispatcher writes.

"When you see a Packard on the highway, you don't have to guess what kind of car it is."—El Paso, Tex., salesman.

"Service is important to us. We have found no dealer as obliging as Packard's."—Webster, N. Y., teacher.

"Most comfortable sitting position for cross-country drives causing less fatigue after many hours of continued driving."—

Most of the owners responding to the PM poll own the Clipper line. This is the 1953 Clipper Deluxe.



On steep hills used by Clymer for his test of the Packard, the long-stroke, straight-8 Clipper Deluxe showed that it has excellent low-speed lugging power

The true test of a car begins when the owner takes the wheel. Popular Mechanics sent questionnaires to 1000 Packard owners. Here is what they have to say





ACCELERATION TEST

1953 PACKARD CLIPPER DELUXE
WITH ULTRAMATIC DRIVE

| | | |
|-----------------------|------------------------|-----------------------------|
| 1/4 mile from zero | 21.7 sec. 20.8 sec. | Drive only Drive and Low |
| 1/2 mile from zero | 33.7 sec. 32.5 sec. | Drive only Drive and Low |
| 0 to 30 m.p.h. | 4.8 sec. | Low only |
| 0 to 60 m.p.h. | 18.1 sec. 17.6 sec. | Drive only Drive and Low |

(Where both Drive and Low were used, shift was made at about 30 m.p.h. with wide-open throttle)
Top speed by speedometer 105-107 m.p.h.
Actual top speed about 7% less (speedometer variation)

ECONOMY TEST

Constant-Speed Mileage

| | | |
|-----------------------|-------|-------------|
| At constant 30 m.p.h. | - - - | 20.8 m.p.g. |
| At constant 50 m.p.h. | - - - | 19.1 m.p.g. |
| At constant 60 m.p.h. | - - - | 16.6 m.p.g. |
| At constant 75 m.p.h. | - - - | 13.1 m.p.g. |

Cross-Country Mileage

| | | |
|--|-------|-------------|
| From Los Angeles to San Diego, Calif., and return | - - - | 18.1 m.p.g. |
| From Los Angeles to Lake Arrowhead, considerable mountain driving | - - - | 16.2 m.p.g. |
| Lake Arrowhead to Los Angeles, via Mojave Desert | - - - | 17.7 m.p.g. |

(Premium gasoline is recommended and was used throughout test except from Lake Arrowhead to Los Angeles)

Packard owners agreed that their power brakes are excellent. They make tiptoe, left-foot braking safe

Hartsdale, N. Y., traveling representative.

"Interior styling commented on by all who see it."—Raleigh, N. C., salesman.

People are buying Packards for many reasons, but the one that showed up most frequently in our survey was previous satisfactory ownership. Three out of five had owned Packards before.

Clipper Comments

But even owners who rate their cars excellent have complaints. These are some:

"Poor gasoline mileage and Ultramatic too sluggish. Wastes too much power getting started."—Ft. Wayne, Ind., accountant. Poor gas mileage was the most frequent complaint of Clipper owners—14 percent mentioning it.

Average gasoline mileage of owners reporting was 12.7 miles per gallon in the city and 15.7 miles in the country with the Clipper. The Clipper Deluxe owners reported an average of 12.6 in city, 15.8 in the country. Owners of the larger Packards averaged 11.9 and 15.0, the survey showed.

Next most frequent complaint of Clipper owners was water leaks in the body.

"Both doors leak in driving rain. The joint in the rain strip on roof is placed so if it leaks (and both mine do), they funnel water into the doors when they are opened."—Palos Park, Ill., typesetter. Similar statements came from 12 percent of the Clipper owners.

"Very poor chrome trim. Paint doesn't

High-speed panic stops with power brakes make front end dip sharply. Very little pedal pressure is needed



Packard owners in 20 states (in green) took part in PM's coast-to-coast poll

Percentages from PM Poll of Owners



Packard Clipper owners reporting: 43%
Clipper Deluxe owners: 35%

Cavalier, Mayfair or Convertible owners: 11%
Patrician owners: 9% Custom owners: 2%

ALL PACKARD OWNERS REPORTING

| | |
|--|------|
| Average speedometer mileage..... | 4841 |
| Use premium gasoline..... | 92% |
| regular gasoline..... | 8% |
| Average mileage for oil change..... | 1653 |
| Add oil between changes..... | 2% |
| Owners of Ultramatic transmission..... | 74% |
| conventional transmission and overdrive..... | 15% |
| conventional transmission only..... | 11% |
| Owners rating power steering worth cost..... | 53% |
| Owners rating power brakes good..... | 97% |
| fair..... | 3% |
| poor..... | 0% |
| Owners preferring V8 to straight 8..... | 28% |
| Owners preferring straight 8..... | 45% |
| Owners with no stated preference..... | 27% |
| Previous Packard owners..... | 59% |
| Dealer service excellent..... | 50% |
| good..... | 23% |
| average..... | 17% |
| poor..... | 10% |

RATINGS OF PARTICULAR FEATURES

| | Like | Acceptable | Dislike |
|--------------------------|------|------------|---------|
| Visibility, forward..... | 98% | 2% | 0% |
| Visibility, rear..... | 92% | 5% | 3% |
| Exterior styling..... | 92% | 7% | 1% |
| Riding qualities..... | 90% | 8% | 2% |
| Length of wheelbase..... | 86% | 13% | 1% |
| Horsepower output..... | 80% | 18% | 2% |
| Interior styling..... | 76% | 20% | 4% |
| Engine noise..... | 55% | 33% | 12% |

CHIEF PURCHASE REASON (in order of frequency)

1. Previous Packard ownership
2. Styling features (exterior or interior)
3. Quality received for money
4. Driving ease (roadability or handling qualities)
5. Riding qualities (comfort, wheel suspension, etc.)
6. Trade-in allowance for previous car

PACKARD OWNERS BY MODELS

| | Clipper | Clipper Deluxe | Other models |
|---------------------------|---------|----------------|--------------|
| Average miles per gallon— | | | |
| city | 12.7 | 12.6 | 11.9 |
| country | 15.7 | 15.8 | 15.0 |
| Readability | | | |
| excellent | 79% | 85% | 87% |
| good | 21% | 14% | 9% |
| unsatisfactory | 0% | 1% | 4% |

| | Clipper | Clipper Deluxe | Other models |
|----------------------|---------|----------------|--------------|
| Handling | | | |
| excellent | 80% | 72% | 93% |
| good | 19% | 28% | 6% |
| unsatisfactory | 1% | 0% | 1% |

| | Clipper | Clipper Deluxe | Other models |
|----------------------|---------|----------------|--------------|
| Structural rigidity | | | |
| excellent | 58% | 55% | 77% |
| good | 33% | 37% | 19% |
| unsatisfactory | 9% | 8% | 4% |

| | Clipper | Clipper Deluxe | Other models |
|------------------------------|---------|----------------|--------------|
| Acceleration from standstill | | | |
| excellent | 51% | 49% | 41% |
| good | 45% | 46% | 50% |
| unsatisfactory | 4% | 5% | 9% |

| | Clipper | Clipper Deluxe | Other models |
|-----------------------------|---------|----------------|--------------|
| Acceleration from 50 m.p.h. | | | |
| excellent | 69% | 71% | 75% |
| good | 29% | 28% | 22% |
| unsatisfactory | 2% | 1% | 3% |

| | Clipper | Clipper Deluxe | Other models |
|----------------------------|---------|----------------|--------------|
| Would buy another Packard? | | | |
| yes | 61% | 65% | 76% |
| possibly | 35% | 32% | 20% |
| no | 4% | 3% | 4% |

| | Clipper | Clipper Deluxe | Other models |
|------------------------|---------|----------------|--------------|
| Over-all rating of car | | | |
| excellent | 56% | 61% | 73% |
| good | 38% | 30% | 20% |
| average | 5% | 8% | 6% |
| poor | 1% | 1% | 1% |

| | Clipper | Clipper Deluxe | Other models |
|--|---------|----------------|--------------|
| Most frequent complaints of Clipper owners | | | |
| Gasoline economy poor | | | 14% |
| Water leaks in body | | | 12% |
| Poor paint and chrome | | | 10% |
| Acceleration poor | | | 9% |
| Noisy body | | | 9% |

| | Clipper | Clipper Deluxe | Other models |
|---|---------|----------------|--------------|
| Most frequent complaints of Clipper Deluxe owners | | | |
| Gasoline economy poor | | | 14% |
| Noisy engine | | | 12% |
| Water leaks in body | | | 9% |
| Rear end noisy | | | 8% |
| Acceleration | | | 7% |

| | Clipper | Clipper Deluxe | Other models |
|--|---------|----------------|--------------|
| Most frequent complaints of owners of other models | | | |
| Gasoline economy poor | | | 13% |
| Acceleration poor | | | 13% |
| Poor paint and chrome | | | 7% |
| Engine noisy | | | 6% |
| Water leaks in body | | | 6% |

hold up. Car arrived from factory in rough condition (nicks and dents). — Falls Church, Va., television announcer. Agreeing with his criticism were 10 percent of the Clipper owners reporting.

Other principal complaints of the Clipper were poor acceleration and excessive body noises (both voiced by 9 percent of the owners). Here are two sample quotations on these points:

"I get a very sluggish start in high range.

However, in low range my Packard Clipper is a regular hot rod. My next Packard will have a standard transmission with overdrive." — Grand Saline, Tex., jet pilot.

"Complaints are mainly minor but annoying. Leaky doors, windshield. Poor seat construction and materials. Annoying squeaks. Weak shocks and springs. If body's interior were as good as motor, it would be a world beater." — writes a Hutchinson, Kans., salesman.

1953 PACKARD SPECIFICATIONS

ENGINE

| | Clipper | Clipper, Deluxe, Mayfair, Convertible | Cavalier, Patrician, Custom |
|---------------------|---|--|---------------------------------|
| Type | Inline 8, L-head | | |
| Bore and stroke | 3½ in. x 3¾ in. | | |
| Piston displacement | 288 cu. in. | | |
| Brake horsepower | 150 at 4000 r.p.m. | 160 at 3600 r.p.m.—Clipper Deluxe | 180 at 4000 r.p.m.—others 8.0:1 |
| Compression ratio | 7.7 : 1 | | |
| Transmission | 3-speed conventional standard. Overdrive or Ultramatic Drive (torque converter with gears) optional extra. Ultramatic standard on Patrician only. | | |

GENERAL

| | | | |
|---------------------------|---|--|--|
| Steering ratio (over-all) | 27.8:1 | 30.9:1 | 30.9:1 |
| Steering, lock to lock | 4½ turns | 4¾ turns | 4¾ turns |
| Turning diameter | 41 ft. | 43 ft. | 45 ft. |
| Brakes | Hydraulic, riveted linings | | Easamatic power brakes optional extra |
| Tire size | 7.60 x 15 | 8.00 x 15 | 8.00 x 15 |
| Shipping weight (4-dr.) | 3725 lb. Clipper 3745 lb. Clipper Deluxe | 3890 lb. Mayfair 4080 lb. Convertible | 3960 lb. Cavalier 4190 lb. Patrician 4300 lb. Custom |
| Wheelbase | 122 in. | 122 in. | 127 in. 149 in. Custom |
| Tread, front | 59½ in. | 60 in. | 60 in. |
| Tread, rear | 60½ in. | 60½ in. | 60½ in. |
| Over-all length | 213½ in. | 213½ in. | 218½ in. 240½ in. Custom |
| Over-all width | 77⅞ in. | 77⅞ in. | 77⅞ in. |
| Over-all height | 62⅛ in. | 62 in. | 62⅛ in. |
| Minimum road clearance | 8⅓ in. | 8⅓ in. | 8⅓ in. |

CAPACITIES (same for all models)

| | |
|---------------------|---------|
| Oil | 7 qt. |
| Water (with heater) | 20½ qt. |
| Gasoline | 20 gal. |

INTERIOR DIMENSIONS

| | | |
|------------------|---------|----------------|
| Front-seat width | 62¾ in. | 62¾ in. |
| Rear-seat width | 62 in. | 62 in. |
| Headroom, front | 36 in. | 58 in. Custom |
| Headroom, rear | 34½ in. | 36 in. |
| Legroom, front | 43½ in. | 35¼ in. |
| Legroom, rear | 43¾ in. | 34⅓ in. Custom |

There were other comments by Clipper owners which are of interest.

"Transmission is slow to drop back into low gear when going up a hill or when I have been forced to slow down."—Bethel, Kans., chemical engineer.

"With a load in trunk, rear springs too weak. It raises your headlights for night driving."—Kansas City, Kans., owner.

"Only serious drawback is resale . . ."—Oak Lawn, Ill., employment representative.

It's a big car, but Packard's excellent vision (all four fenders are visible to driver) makes parking easy

"Front ash trays are poorly illuminated at night and are too low. Driver's ash tray is directly above his leg which is dangerous."—New York City dry cleaner.

"On rough roads it seems like the body is not built too sound."—Defiance, Ohio, truck driver.

Clipper Deluxe Comments

As with the Clipper, gas consumption
(Continued to page 232)





Folding Spikes for Tractor Wheels Boost Traction

Up to 200 pounds of weight are added to each tractor wheel by folding lugs. The added weight increases the traction at all times, but when the terrain is especially rough or slippery the farmer can unfold

the triangular spikes which bite deep into mud or snow. Each wheel unit is bolted permanently in place, eliminating the need for changing the fluid content of tires, putting on chains or adding weights.

Milking Machine Travels to Cow

European dairy farmers now take their milking machines to the herds in the pasture instead of bringing the cows into a milking parlor. The machines are mounted on a three-wheel truck which is driven into the field. A pump powered by the truck's engine operates the machines. Eight cows can be milked at once.



Metal Awning Folds Up To Let Sunshine Enter

Sturdy and permanent but non-rigid, a new metal awning can be raised or lowered as easily as if it were canvas. Its several sections nest on top of each other, separated by air spaces which let cooling breezes pass through. A tug of a rope inside or outside the house telescopes the sections, raising them to any intermediate position or folding them against the house.

Last year the international airlines carried more than 1,300,000 passengers to or from United States airports — about 300,000 more passengers than the steamship lines carried.



Fireplace in front yard is built into side of hill. Lava appearance of hill comes from stippled Gunite

HOUSE FOR THE ATOMIC AGE

Television set is built into huge tree trunk fitted into wall of living room. Dials are mounted at side



A SWIMMING POOL that becomes an automatic decontamination bath during an A-bomb attack is one of the features of a home that Hal B. Hayes, Hollywood contractor, is completing for himself. In the hillside next to the swimming pool he's building an underground sanctuary that you reach by diving into the pool. His house

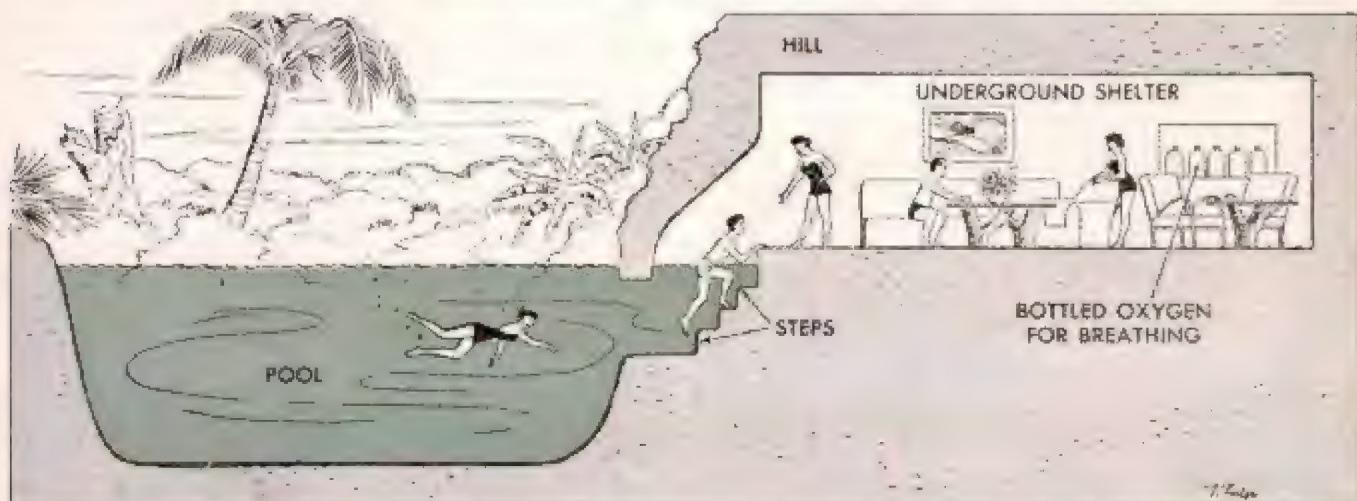
Tree trunks and limbs are used for furniture, here support the glass top of table which Hayes is using





Solid wall is fluted to resist shock waves. Fragile glass front could be replaced easily after blast

Cutaway shows approach to underground sanctuary via swimming pool. Hayes figures that any radioactive contamination on a person's body would be washed off while swimming to the entrance of the sanctuary





Pieces of driftwood against backgrounds of swirled linoleum paste form striking decoration in master bedroom

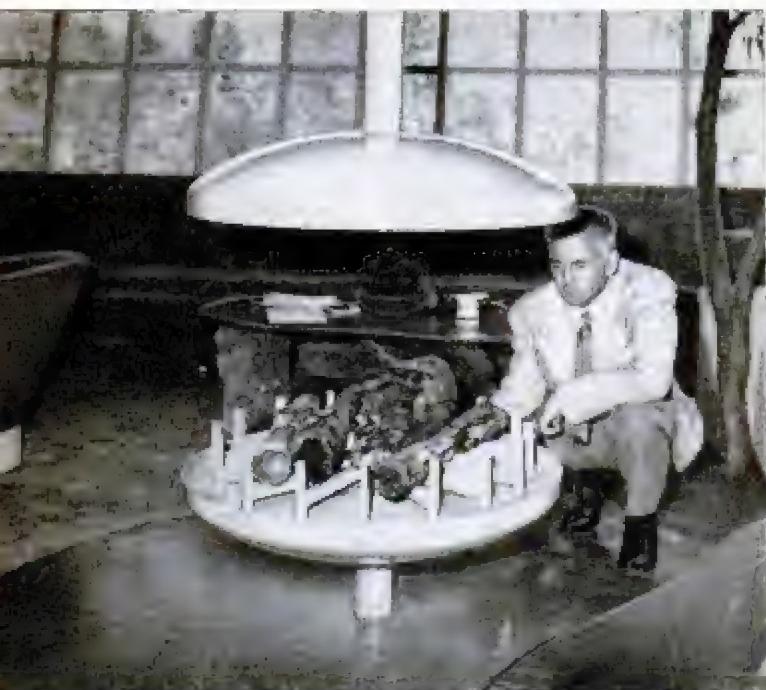
is designed to "bring the outdoors indoors" for ordinary peaceful living, yet has a structure built to resist great destructive forces. Several of the walls are completely of glass that would be swept away by a powerful shock wave, but could later be replaced. A continuation of his living-room rug is pulled up to shroud the glass wall in that room when a button is pressed.

Other walls of the house have a fluted design to resist shock wave and a fireproof exterior surface of Gunite.

Smoke from midroom fireplace is caught by umbrella canopy, drawn up the chimney by fan mounted inside

A garden growing in half a foot of soil on the flat roof provides insulation against extreme heat or shock. All exposed wood, inside and outside of the house, is fire-resistant redwood coated with fire-retarding paint. In addition to the underground sanctuary, equipped with bottled oxygen, there is a bombproof shelter in the house itself, consisting of a large steel-and-concrete vault containing a sitting room and bathroom. Other features of the home include a three-story indoor tree. ★★★

Tree inside house extends full three stories, here passes through large floor window of louvered glass





Main entrance of house is through tunnel visible at left. Glass walls at right protect an orchid grotto

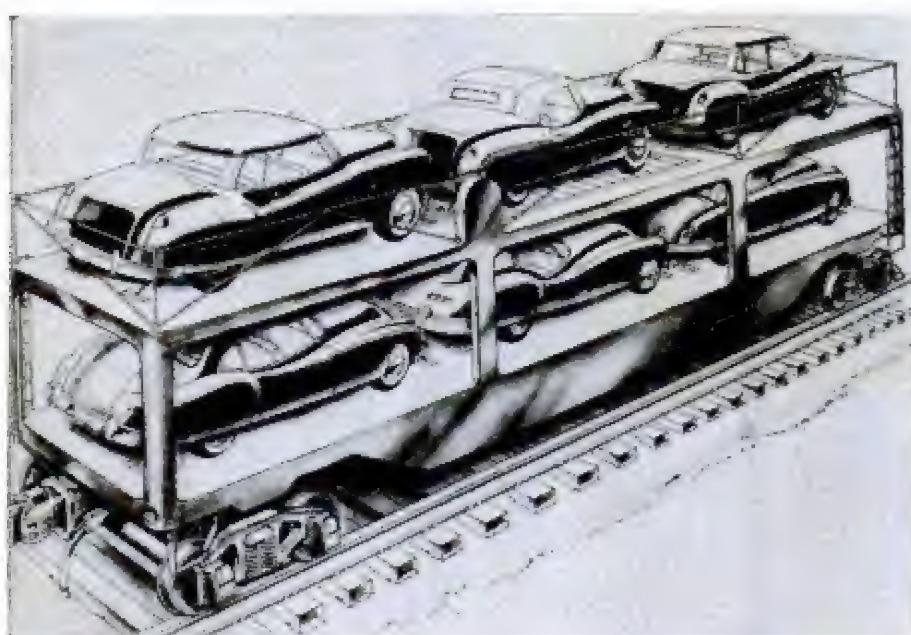
Car is parked on cantilevered steel tracks which overhang cliff below house. Space is at a premium

Bomb shelter in the house itself has strong steel shutters which can be closed in case of air attack





SPINNING BUS at Frankfurt, Germany, isn't doing this to amuse its passengers—it is simply a mechanical display to enable visitors at the automobile show to see all sides, top and bottom of the 52-passenger vehicle



Double-Deck Flatcar Carries Six Cars

Automobiles can be shipped six to a railroad car with a special frame that can be built on a standard flatcar. An elevating ramp in the center of the car permits two automobiles to be driven to the top deck. The ramp itself is then raised with the third car on it, filling up the top deck. Then three more cars are driven into the lower deck and all are tied down to prevent shifting in transit.

Cotton Harvester For Small Tractor

Cotton is harvested at a rate of $1\frac{1}{4}$ acres per hour by a mechanical picker designed for small tractors. Rotating nylon brushes remove the cotton and cotton burr from the stalks. The cotton and burr then move to a bypass fan and are delivered to a wagon or a basket mounted on the tractor. The tractor's hydraulic system lifts and lowers the harvesting mechanism and dumps the cotton basket.



Kit Provides Materials for Building Inboard Engine in Small Boat

With a kit complete to the last bolt and washer, the small-boat owner can install an inboard engine in his craft. This type of engine sometimes is preferred by anglers for trolling. The kit includes the engine, propeller gear, rudder, steering controls and directions to show the boatowner where and how to install the various parts. The completed installation has a three-position lever for shifting into forward, neutral or reverse.

Turf Grippers Clamp to Shoes

Especially useful to the infrequent golfer, or one who travels and doesn't carry a pair of golf shoes, is a turf-gripping device that attaches to the shoe sole. It also provides greater traction for walking on icy pavement. Made of stainless steel, the turf gripper comes in one size for women, girls and boys and in an adjustable size to fit wide or narrow shoes for men. Four cleats slip over the golfer's shoe sole to hold the turf gripper firmly in place.



British Lamp Used in Medical Research Outshines Sun

Brighter than the sun, a lamp designed by British scientists is said to be the most powerful for its size yet developed. In fact, it's claimed to be the brightest lamp ever seen on earth. Peak strength of the bulb, filled with xenon gas, is 1,000,000 candlepower to the square inch. That of the sun is about 800,000. At the present time, the lamp is being used in many forms of medical research, including cancer study.

Miners at the Lake Shore Gold Mine, Kirkland Lake, Ontario, will work a mile and a half below the ground surface when the deepest diggings in the Americas are opened at 8075 feet.



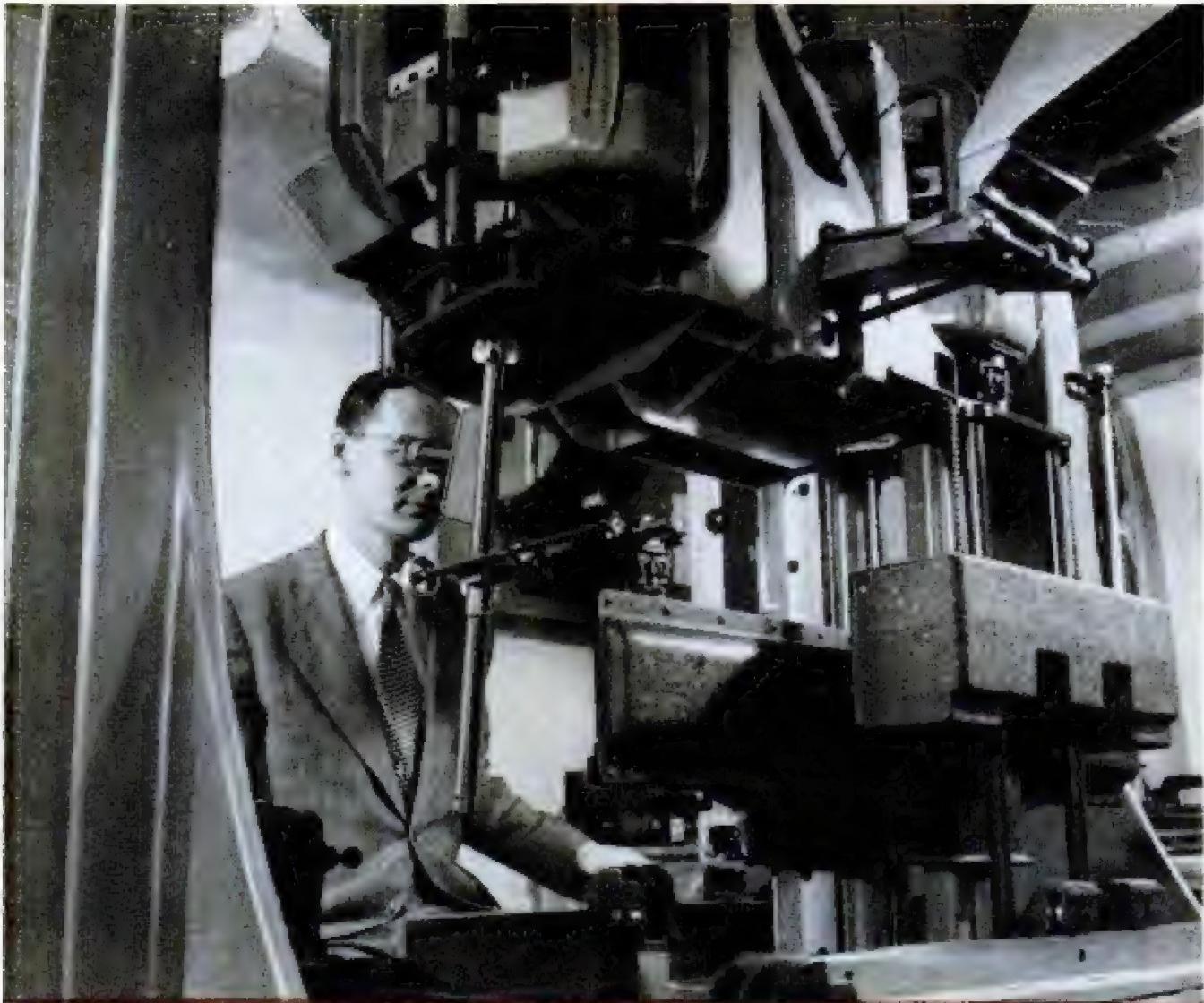


Photo from the International Aerial Survey Centre, The Netherlands

Weirdly precise machine measures the movement of a dot of light to draw the finest survey maps

Remember the bouncing dot that led the old movie-theater songfests? It has become the surveyor's three-dimensional tool. Now they're

Mapping the World With the "Educated Dot"

In minutes the dot can accurately map rugged terrain that the surveyor could cover only in weeks of work

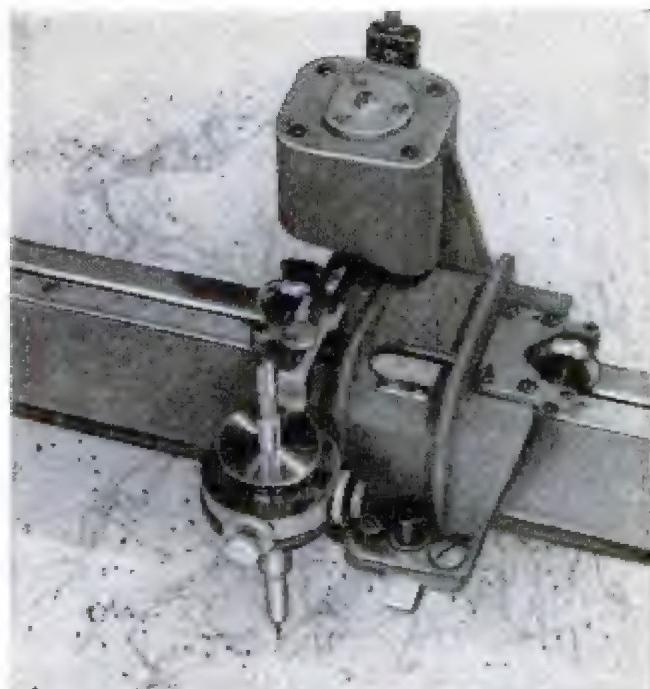


A BOUNCING DOT—yes, a saucy little dot like the one that pointed out the words for you in old movie songfests—is today hopping over photos of the land, mapping this entire globe of ours with an accuracy never before possible.

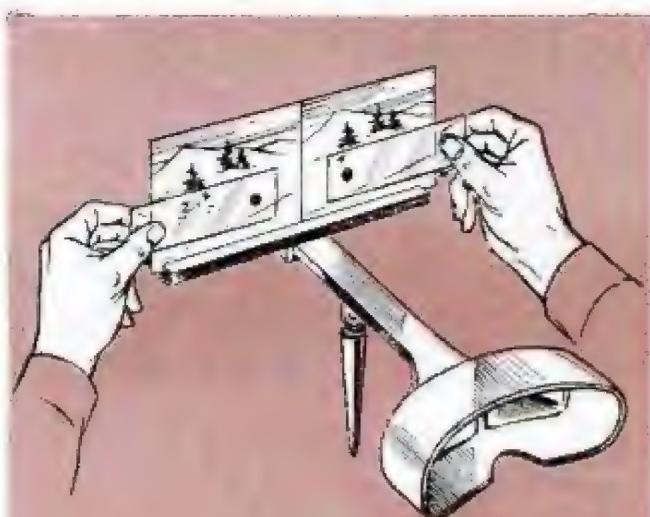
This “educated dot,” now made stereoscopic, is truly the Paul Bunyan of surveyors. It is a nimble pin point of light with the ability to leap instantly from valley to mountaintop, measuring and mapping as it goes. Completely an internationalist, it was invented both in Germany and the United States. It has been perfected in Switzerland. It is already in use by most nations of both hemispheres, and in 1951 an international college was established by the Netherlands government to give courses in its use to students of mapping, with many scholarships being sponsored through the United Nations. Besides busily measuring away on a global scope, this precocious little dot has also re-educated the scientists who design camera lenses. You need only enter the headquarters of a large government surveying agency, the Army Map Service or one of the larger private agencies which map oil fields and the like to find the dot. You’ll locate it in a laboratory where a white-coated “surveyor” sits in front of a gargantuan, multiarmed machine called the autograph. He sees the bouncing dot but you can’t unless he relinquishes his seat, because the educated dot inside his machine is an aloof little thing, actually a stereoscopic unreality that only seems to exist when two tiny dots of light are precisely focused on a stereoscopic pair of aerial photos.

Formerly, any truly accurate map was one that had to be made by surveyors laboriously crawling over the surface of our globe, measuring each little rise or depression and measuring its distance from the next or from one of a billion starting points. Then the contours of the ground had to be estimated and sketched on a map.

The educated dot solves such problems nicely. A precise aerial camera takes a series of straight-down photos from high altitude. These photos are handed to the laboratory surveyor, who places them in his autograph. He inserts an overlapping, or stereoscopic pair—similar to the pair of photos you inserted in an old-fashioned stereoscope. He peers through two eyepieces and views the stereoscopic scene of the ground exactly as if he were in the airplane over it. So far he has done little more, except in precision, than you could do by snapping the same scene from an airplane with a modern 35-mm. stereocamera and viewing the pictures at home. But this



Solenoid-controlled pencil on the map table reproduces every move of the “educated dot.” Black spots are houses, precisely located along with contour lines



How to ‘Educate’ a Dot

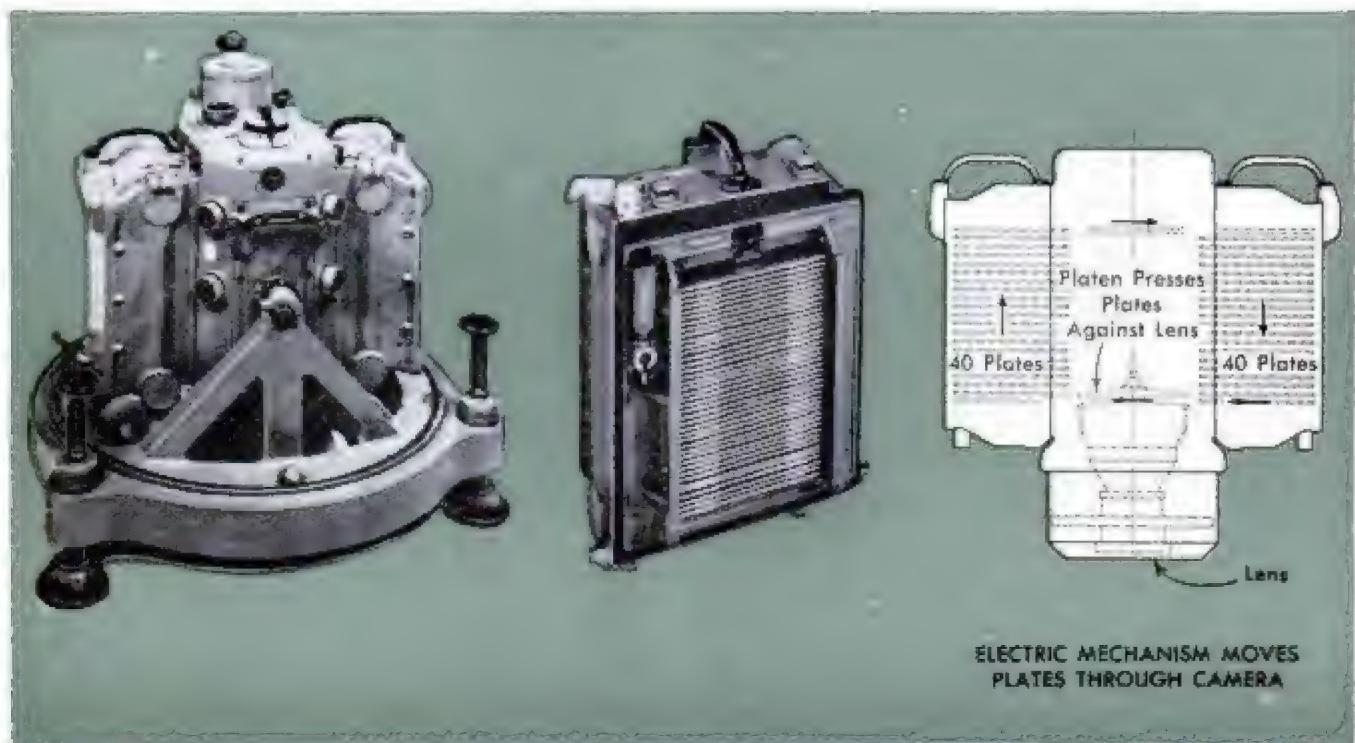
An old-fashioned stereoscope can be used to demonstrate the principle of the educated dot and the new autograph. If you ink a dot on each of two strips of cellophane, then move the strips slowly together in front of the stereophotos, the illusion of a three-dimension dot will appear before your eyes, hovering in front of the scene. Surprisingly, when the two strips are moved apart or together, the dot will appear to move closer to you or farther away. The new surveying system works in exactly the same way except for its precision. The autograph is a mechanism machined to tolerances of 1/50,000 inch which, in effect, moves the two strips and measures that movement. It also has an elaborate optical system to exaggerate the movement, and an arm which sweeps across a map table to translate movements of the dot to a tracing pencil.



Simpler and less expensive machine than autograph is Kelsh Plotter which also makes maps. It uses red and blue dots. Observer wears red-and-blue glasses



Taking photos for the dot. Man at right operates camera, assistant gives pilot instructions through microphone. Camera, below left, has a magazine of 40 photo plates on each side. Magazine is shown in center. Mechanism shuffles plates through camera



surveyor flips a switch which brings the educated dot before his eyes.

The dot, actually two precise pin points of light, one on each of the photos, is stereoscopic. It seems to float like a bird in the air below him (remember, he is viewing it as if high in an airplane). His hands operate two control wheels that move the floating dot anywhere on the stereo scene. The toe of his right foot operates another wheel that moves the dot straight up or down through the "air" of the scene. And here is the key to this new map making—any movement that he makes to maneuver the dot is precisely measured by the autograph.

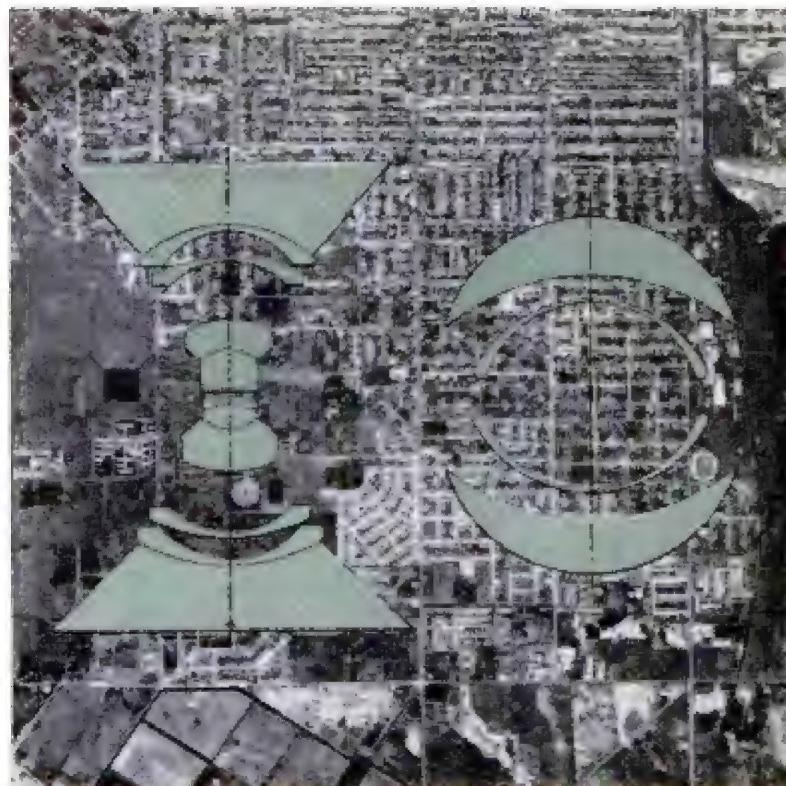
Thus the surveyor can speed the dot across the sky and down to touch, say, a mountaintop. As he does so, an electrically controlled pencil races a corresponding amount across a drawing table that is attached to the right side of the machine. When he presses a button with his left foot, the pencil draws in that mountaintop at its precise location on the map he is making. From the movement with his right foot to lower the dot to the mountaintop, the machine measures the exact height of the peak. He then can move the dot a bit down the mountainside and accurately draw in one of its contour lines by simply rubbing the dot around the peak at that level. Or, he can maneuver the little dot to follow the intricate path of a stream, have it trace the outline of a building or move down a fence line or road. The machine automatically reproduces each of them on the map, along with exact measurements. And this surveyor need only to shift the knobs of an intricate gearbox to produce the map in any size or scale he desires.

Mapping with aerial photos is not new.

What the educated dot does for aerial mapping is to make it highly accurate and inexpensive. The man at the machine in one day supplants weeks of tedious computations and manipulations that were required by former aerial-mapping techniques, and those in turn were much faster than surveyors on the ground. The map he produces is far superior. Actually, an airplane could fly over your neighborhood tomorrow, so high you probably would not notice it, and from its photos the educated dot could tell that the neighbor's fence encroaches on your property and that a corner of your potato patch is a foot lower than the rest of the patch.

What does this mean to you, besides a lawsuit with the neighbor over that fence? For one thing, it means that some day soon our whole nation can be accurately mapped. This country has been mapped several times, but only with a hit-and-miss accuracy—for the simple reason that all the surveyors available since 1776 are far short of enough to do that one job properly on the ground. As a result, there are few places in the United States that do not require a laborious and slow remapping on the ground. Without such maps, no one can plan an irrigation system, dam, highway or factory, or even know for certain who owns a piece of property.

The educated dot also is a boon to the Army, which is in need of up-to-date, ac-



Aviogon lens, diagrammed above left, has unusual telescope design compared to the Metragon lens, right, used during World War II. Photo was taken with Aviogon at altitude of 17,000 feet

curate tactical maps to show who and what is in front of the troops. Already, the Army Map Service is using a new portable autograph that can be transported in a trailer, bringing the educated dot directly to field headquarters.

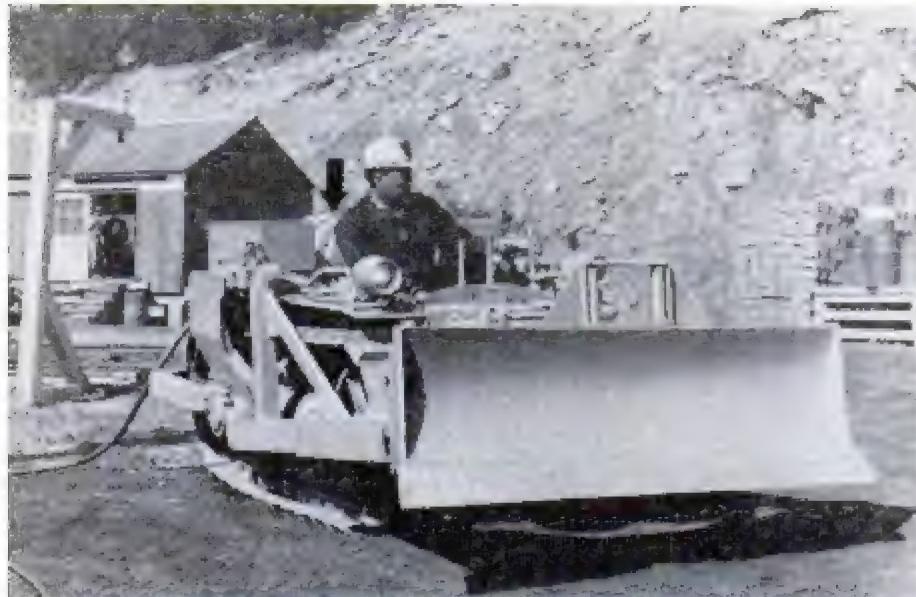
Alert corporations, too, are watching the bouncing dot. Oil and lumber companies are having their remote but valuable lands pin-pointed and are using the dot as an explorer to find new mineral formations, oil

(Continued to page 222)

"Surveyor," left, rubs dot over scene. Assistant notes elevations and other data computed by autograph



Electric Bulldozers Operate Underground in Utah Coal Mines



In three Utah mines coal is piled by the quietest bulldozers in use today—they are powered by electricity. Safety regulations forbid the use of internal-combustion engines underground, so the U. S. Fuel Company turned to electric power. The 250-volt motor (arrow) develops only 15 horsepower, but that is ample because of the efficiency of electricity. Reel winds up the cable behind the tractor to prevent damage.

Army's Amphibious Cargo Carrier Made of Aluminum to Reduce Weight

Snow, mud or water, it makes no difference to the Otter, the amphibious cargo carrier, which is now being built of aluminum to reduce weight. Believed to be the first all-aluminum ground vehicle ever mass-produced, the Otter weighs only four tons. The Army plans the vehicle for nonarmored, noncombat use and its weight fits it for airborne operations. It has a top speed of about 28 miles per hour on land and about 4 miles per hour in water when propeller-driven at the stern.



Dutch Entertainer Rides Tiny Bike

Billed as the world's smallest bike-riding act, a performer in a Dutch circus pedals around the ring on a bicycle no bigger than a shoe. The wheels are only 1.3 inches in diameter and the handlebar 2 inches long. Yet, the machine is strong enough for the cyclist to ride. It is so small that it is almost hidden by the rider's hands and feet.

Shooting it into solid wood at close range won't shatter the glass shaft of a new arrow.



Skylight distributes light evenly throughout room, provides proper illumination on cloudy or sunny days

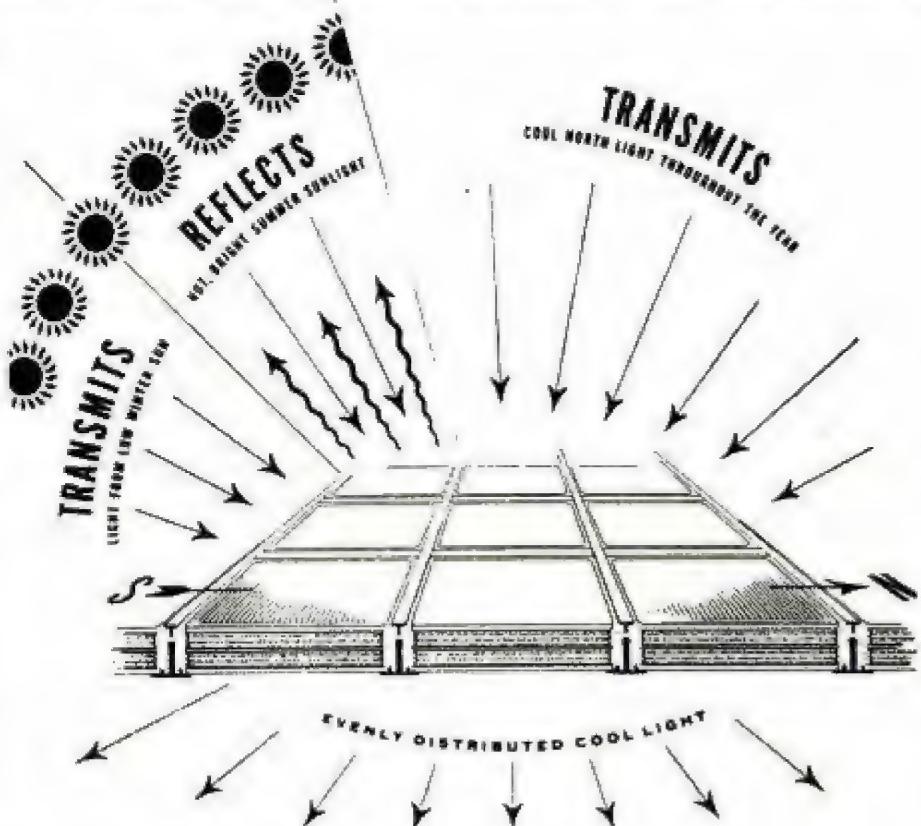


Prisms in top layer let slanting rays through but block overhead light. Bottom layer diffuses rays

Selective Skylights Control Sun's Rays

"Selective" glass which transmits the entire output of the winter sun but reflects hot, glaring sunshine in the summertime is going into the latest skylights. The top layer of glass is ribbed and positioned so that there is high light transmission from the north half of the sky and from the lower part of the south sky. The low transmission of daylight comes from the section of sky which contains the hot, bright summer sun. Two layers of glass below the prism glass distribute the light evenly throughout the room, providing adequate lighting even on overcast days.

Glass must be properly positioned to catch light from north and south



Growing Blanket of Carbon Dioxide Raises Earth's Temperature

Earth's ground temperature is rising $1\frac{1}{2}$ degrees a century as a result of carbon dioxide discharged from the burning of about 2,000,000,000 tons of coal and oil yearly. According to Dr. Gilbert N. Plass of the Johns Hopkins University, this discharge augments a blanket of gas around the world which is raising the temperature in the same manner glass heats a greenhouse. By 2080, he predicts the air's carbon-dioxide content will double, resulting in an average-

temperature rise of at least four percent. If most of man's industrial growth were over a period of several thousand years, instead of being crowded within the last century, oceans would have absorbed most of the excess carbon dioxide. But because of the slow circulation of the seas, they have had little effect in reducing the amount of the gas as man's smoke-making abilities have multiplied over the past hundred years.



Adjustable-Wing Jet Resembles Praying Mantis When Landing

Varying degrees of sweepback can be achieved through changes in the adjustable wing of the British SB5. It resembles a praying mantis when it touches down after a flight. Built by Short Brothers and Harland, and test flown in Ireland, the experimental jet aircraft will be used primarily in high-speed-flight research.

Fast-Pickup Rail Busses With Diesel Engines Will Serve Branch Lines



Rail busses powered by diesel engines are scheduled to be delivered this year to the New York, New Haven & Hartford Railroad. The busses are designed for use on branch lines, particularly those that have peak rush hours and only light traffic at other times. Built by Mack, each vehicle will seat 50 passengers and will have controls at each end. Two of the busses can be coupled, if desired. The vehicles' maximum speed will be 54 miles per hour with a high rate of acceleration from a standstill. The busses are expected to be more economical to operate than conventional trains; it will not be necessary to operate a heavy locomotive to pull two or three cars to take care of a limited number of passengers during off-peak hours.

Lockheed Building Turboprop Transport for the U. S. Air Force

Turboprop power will fly the new C-130 military transport which Lockheed is building for the Air Force. The squat, low-slung airplane has a sharply upswept tail section to make room for the built-in loading ramp which serves as the rear door. With four Allison turbine engines and three-bladed propellers, its length is 95 feet, wingspan 132 feet and height 38 feet.





Navy's Most Powerful Helicopter to Hunt Submarines

Developed for antisubmarine patrol, the Navy's most powerful helicopter has been test flown at Fort Worth, Tex. The Bell-

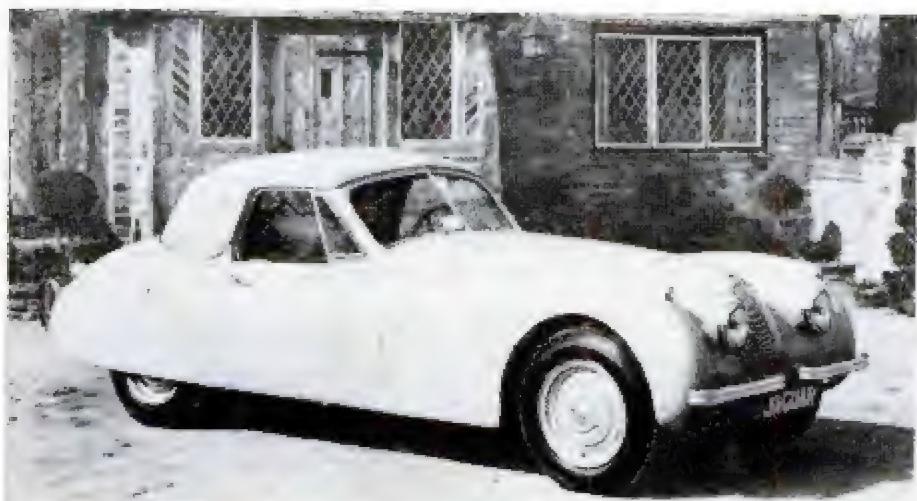
built XHSL-1 has a 1900-horsepower Pratt & Whitney engine driving its twin rotors. It will carry 14 persons.

German GM Car

Built at Russelsheim, Germany, by Opel, a General Motors subsidiary, the new Olympia Rekord has a neat, uncluttered body with a minimum of decoration. Certain design features, such as the hood profile and fender lines, reflect an American influence. Its price is about \$1480 in Germany. The 40-horsepower engine gives the Rekord a top speed of 70 miles per hour.



Record-Breaking Jaguar XK-120 Introduces Soft-Top Convertible Body



Famous the world over as a competition sports car, the Jaguar XK-120 is now produced with a convertible body style. It is built on the same chassis as the sports roadster that holds the world's speed record of over 140 miles per hour for stock-produced cars. The top is made of padded mohair and is lined. The operating mechanism is completely concealed.

"Thursday, we hang," says the director, and the scene makers go into a traffic jam on the TV stage to arrange an elaborate set for its brief moment of glory

The Men Behind the TV Scenes

*By Jan Dawson Jensen
Photos by Robert R. Jensen*

Painted pipes identify this as a basement. The late Max Rée, left, tests the operation of a coal chute



THE TELEPHONE RANG in a television art director's office in Hollywood and an enthusiastic TV writer explained, "Jerry Lewis will drop a bottle of termites, see? And slowly, the whole house and all the furniture will disintegrate, right before your eyes. Can you do it, Furth?"

Furth Ullman, slim, dynamic art director on the National Broadcasting Company's Comedy Hour, reached for his sketch pad and said, "Sure. How much time do I have?"

"We'd like to use it in three weeks, on the next Martin and Lewis show, but we thought we'd better ask you if it's possible before writing it in."

"Go ahead," said Mr. Ullman calmly, for already he was remembering the plastic he'd seen used in the East. The plastic would be strong enough to look realistic and yet so light it would not hurt the actors when it fell on them. The main problem was to design a set that would disintegrate for rehearsals when mechanical trips were operated and yet could be reassembled for final telecast. All the parts, even the furniture, had to fit together.

Ullman's designs were carefully planned and executed, the final sets being a combination of plastic, "breakaway" scenery and muslin. When Jerry Lewis dropped the bottle of termites, the whole room rocked and shook to pieces most satisfactorily,



Top, when Jerry Lewis drops a bottle of termites everything falls apart, bottom, thanks to a special plastic

thanks to the clever art director and his co-workers.

On one All Star Revue, Max Réé and Jerry Decker had to design a set around a swimming pool in which Florence Chadwick was to demonstrate her best channel style. They rented an aluminum pool with plastic windows in the sides for the cameras and placed it in the center of an outdoor terrace, gay with umbrellas and tables.

"Sounds simple, doesn't it?" laughs Jerry Decker. "But remember, even though the pool was only 13 feet in diameter and 5 feet

deep, when it was filled with 5000 gallons of water, it weighed 20 tons and could not be moved. We had to design the whole hour show to work around it. That, to my mind, was the most interesting set we ever did."

In television, men behind the scene are more numerous than wrinkles in a basket of prunes, but the talented few, whose credit lines on the "crawl" at the end of a telecast list them as art directors or set designers, are the scene behind the men. They are a modest, unassuming lot with a tendency to minimize the genius with which



Rée always made models of his sets, like this one of the tank in which Miss Chadwick performed, top

When directors say "We hang today," it's not so bad as it sounds. These men are hanging a building flat

Stagehand holds back swimmer Florence Chadwick with rope as camera at side window shows her style they produce interesting and difficult designs, week after week.

"I'm only a little wheel in a big industry," one said. "No one has time to realize what TV is. We build a whole set for hundreds of dollars, striving for perfection, and it lasts for two minutes. The second the curtain closes, the walls fall apart, the rugs are rolled up, the props disappear and one hour later there's not a trace left because another show has to move in."

Such big variety shows as the Comedy Hour and the All Star Revue give a good half of a Broadway musical each telecast and require multiset planning, flexible enough for quick changes. Time is a Simon





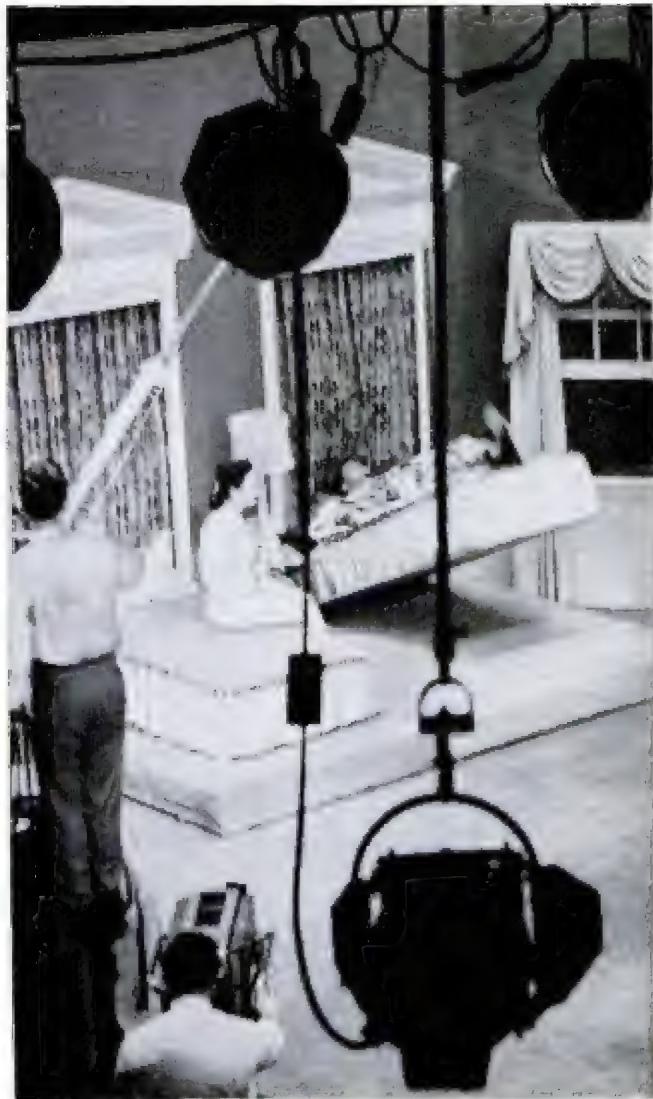
Ben Blue used an in-a-wall-bed trick in a scene with Dorothy Lamour, right. Three men behind set make sure he isn't hurt as he's flipped over by the bed, above

Legree galvanizing them into sleight-of-hand trickery. While one scene is being played, they must strike the previous set and erect another. While cameras focus on stage right, the curtain conceals stage left, which is a beehive of stagehands and prop men, or the whole area may be converted while a scene is being played down in "limbo," television's unique term for the apron.

"We don't make a set just to impress an audience," they say. "Settings for TV must avoid being heavy. They are patterned more after the light-framed, canvas-covered scenery of the stage to create a two-dimensional illusion, but there is a great deal more latitude in television than in the theater."

One week's preparation is allowed for the normal sets on a big show. However, as in the case of the termites, when some particular problem is foreseen the writers and producers give them more time. Ideas for sets are outlined to the art director at a production meeting a week or so before the telecast. Sometimes, he gets the first draft of the script then. At least, he is given a printed sheet called the "breakdown," itemizing the various props and settings planned for each act so he can start right to work. Usually before that first production meeting is over a designer has made quick, rough sketches.

As soon as he returns to his office, the designer goes into a huddle with his draftsman, producing sets drawn to scale, which must be submitted for approval before they can be blueprinted. Some art directors make scale models of their drawings. Chief adherent to this method was the late Max Rée, who designed the sets on the All Star



Revue from September 1952 until his death in March 1953.

"Those models were of especial value," says Jerry Decker, who does the show now. "The directors could look through a small cardboard camera at the set from every angle and determine exactly how much scenery they needed to build and what would be superfluous. Also, it enabled them to tell how much stock stuff they could use, which saved them money."

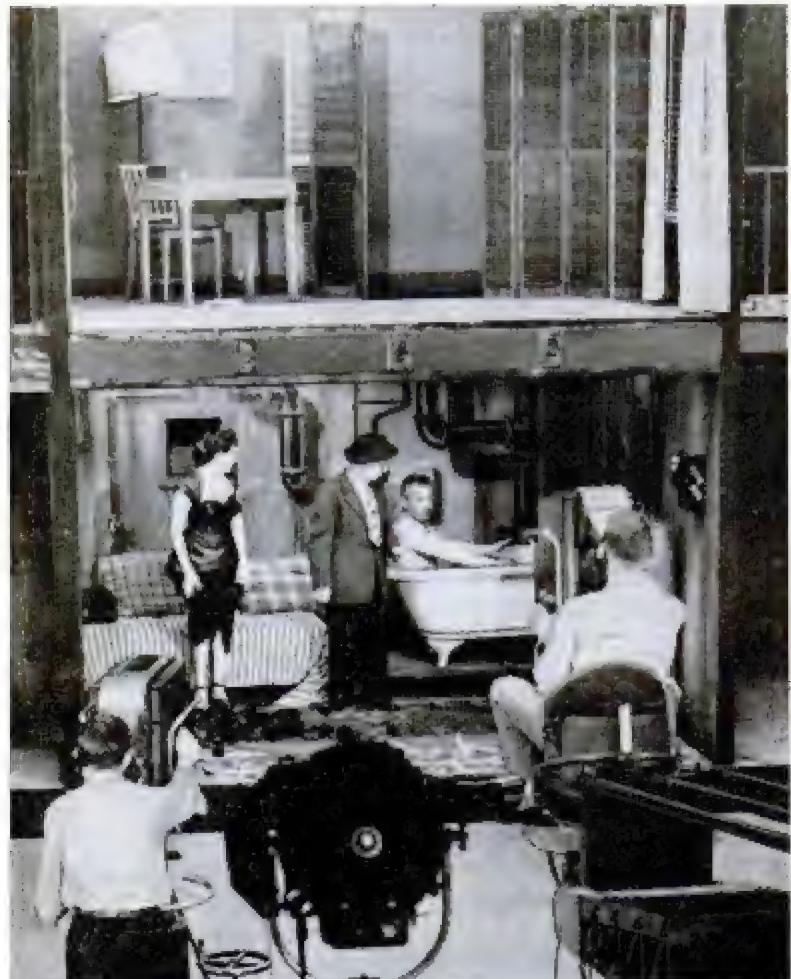
However, other art directors, like Furth Ullman, seldom use scale models, preferring to work out their designs in perspective color sketches, projecting their plans into visual illusions of three dimensions.

"One set for a Jimmy Durante show," says Jerry Decker, "caused a lot of interest and comment. We designed a two-story building with an outside staircase running from a basement room to the floor above. The action required us to work out a scheme to have a bathtub move from the top room to the bottom."

Three sets of blueprints go to the construction and scenic departments, located in the vast workshops behind the Burbank studios, where scenery and props are built. The art director confers with the head of the construction division as frameworks



Everything happens on this two-story set! Pinza is bathing upstairs when a load of coal comes down on Durante and Fifi D'Orsay, above. Suddenly, bathtub, Pinza and all drop through floor to basement, below. Comedy is often difficult to stage



of his settings begin to take shape.

"There's one fellow in that department," chuckles Jerry, "who's a walking encyclopedia. If you want to know technical tidbits like how high the posts are on a boxing ring or how many spokes in the wheel of a Model-T Ford, all you have to do is ask John Griggs. That's the interesting part of this business. No matter what your previous training, you can turn every bit of it to advantage."

As soon as the ghostly, muslin-covered sets are turned over to Joseph Teichner, head of the scenic department, the art director explains his ideas to this talented artist so he can absorb the feel and mood of the show. Seldom does Teichner wield a brush now, but under his direction, 16 artists turn out all the scenery required in Hollywood by NBC, about 24 sets a week. Whatever color combinations are used will be television-wise, for the knack of using just the right shade to give a set depth and value is no hit-or-miss process.

"Experience has taught us," explains Teichner, "that 10 gradations between black and white are sufficient to produce a good television picture but, since a set done entirely in gray tones would be uninteresting to the actors and studio audience, it is necessary to choose blue, red, green and yellow as substitutions. By comparing them through a TV camera with corresponding intensities on the original Munsell chart of over 50 shades of black and white and numbering them accordingly, I worked out my own system for television, resulting in a rack of catalogued colors hanging on my office wall. Each one of the 10 is divided into 8 or 9 different gradations. Now, I know if I pick a certain shade of yellow, which I have marked No. 5, it will be identical to the No. 5 shade of gray on the Munsell chart when reproduced on a television set. White is never used, because it overloads the camera 'orth,' or tube, and causes flare."

Fascinating scenery is brewing under the deft hands of workmen in the big workshop. Strips of muslin are tacked out the length of the hall for sizing. One man sprays lacquer on a fluted oval window to give an opaque-glass effect;

(Continued to page 226)



Steel-Framework Sections Made for Small Homes

Even the small home can now have a steel framework with the introduction of lightweight steel structural sections. The sections, double-trussed for strength and of open-web design for lightness, are made from strip steel by cold rolling. Easier to handle than wood studs or masonry blocks, the steel sections—consisting of joists, studs and other accessories—provide the advantage of being warp, shrink and split proof. The web design simplifies wiring and permits



easy insertion of plumbing pipes. The completed house may be covered with stucco or other siding. The sections are also suitable for schools and commercial buildings.

Right-Angle Putting Practice

Right-angle putting can be practiced indoors on a nine-hole course that can be unrolled over a rug. It is a porous canvas strip, marked with arrows indicating the ball's correct path to the hole from nine starting points. Lines intersecting the path at right angles remind the user to properly position his feet and club head. The hole is adjustable, either to return the ball to the user during practice or to retain it during competitive play.

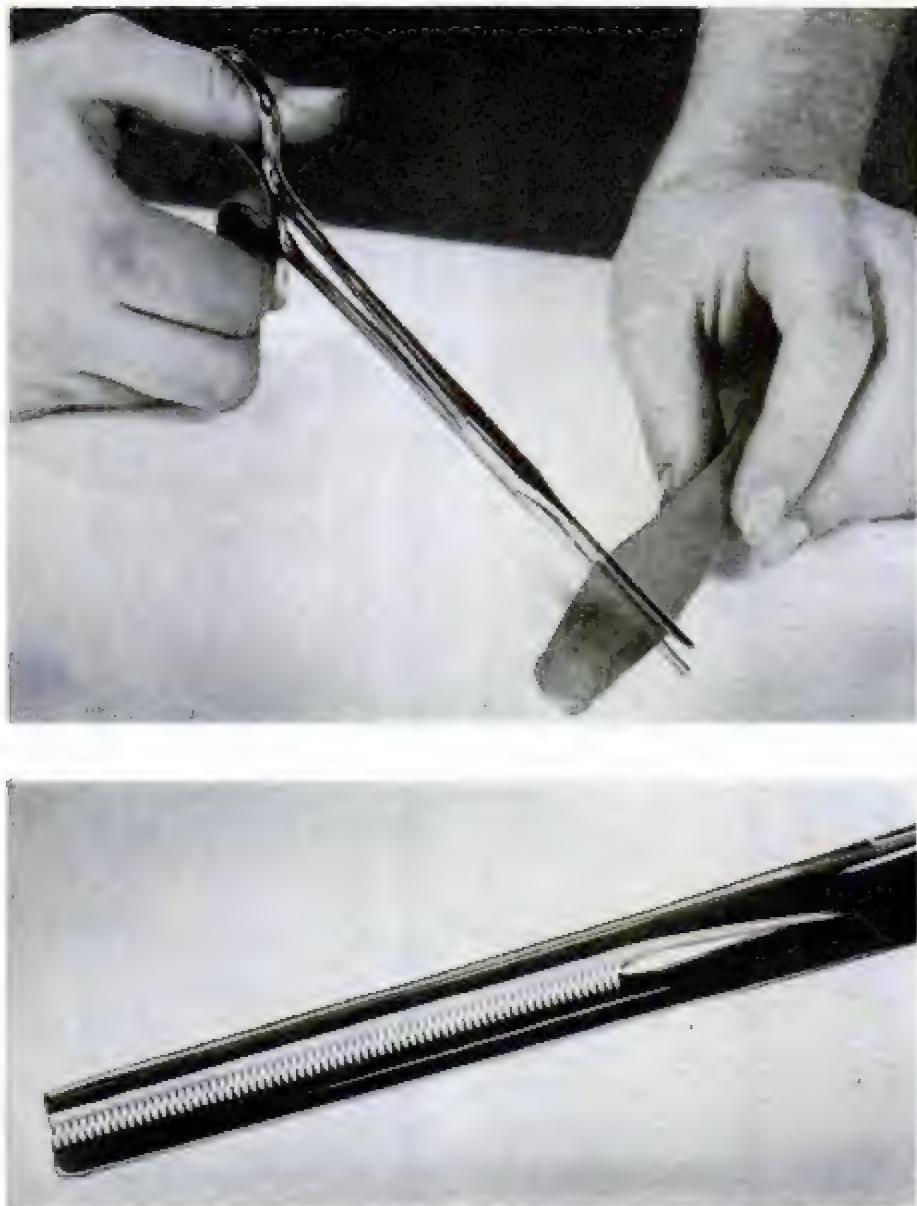


Phone Call Opens Crossing

Many remote railway crossings in West Germany have no watchtower or automatic signal, but that doesn't mean they aren't guarded. The West German Federal Railways is installing a system of remotely controlled barriers at such spots. If motorists or farmers wish to cross the rails, they use a "talkie" to call a central check point, which will either open the barriers if the road is clear, or tell the caller he must wait until a train has passed.



Tiny Teeth in Clamp Close Blood Vessel Without Injury



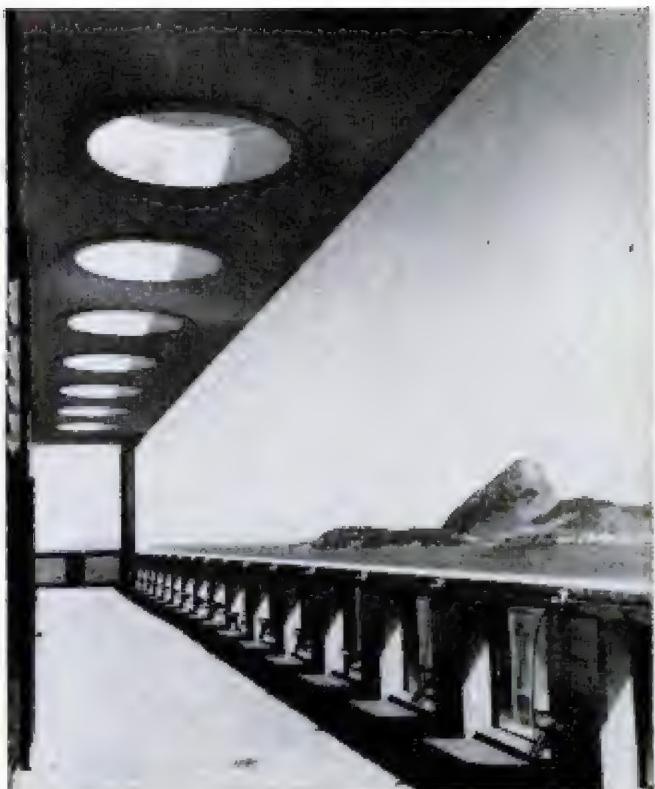
Army surgeons are singing the praises of an ingenious clamp that can close a blood vessel without injuring the delicate inner tissue. The jaws of the stainless-steel clamp, or forceps, have tiny teeth only one millimeter deep and about 40 to the inch. When the clamp is closed over an artery, the many teeth evenly distribute the pressure. Conventional clamps frequently injure arteries. The new clamp is also made with curved jaws which can close off part of an artery without disrupting the flow of blood. This is invaluable in repairing a punctured vessel. The clamp was designed by Dr. Willis J. Potts, noted surgeon of Children's Memorial Hospital in Chicago, who is known throughout the world for heart operations on "blue babies." The first clamps were made by Bruno Richter, expert maker of surgical instruments, in his basement shop. This led to the establishment of an instrument factory.

Operator Rides on Combination Lawn Mower and Roller

You can mow and roll your lawn simultaneously while driving a small machine made in England. The operator sits on a bicycle-type seat mounted directly over the small rear roller. The reel-type mower extends in front of him. The mowing mechanism can be lifted clear of the ground when the machine is passing over walks or driveways. It also can be removed completely, along with the rear roller, and two rear wheels installed so the machine can be used as a miniature tractor.

Information not listed on articles in the index frequently is listed in the WHERE-TO-FIND-IT LIST, which is available to readers without charge from Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11





Striking Latin Design Marks American Embassy in Rio

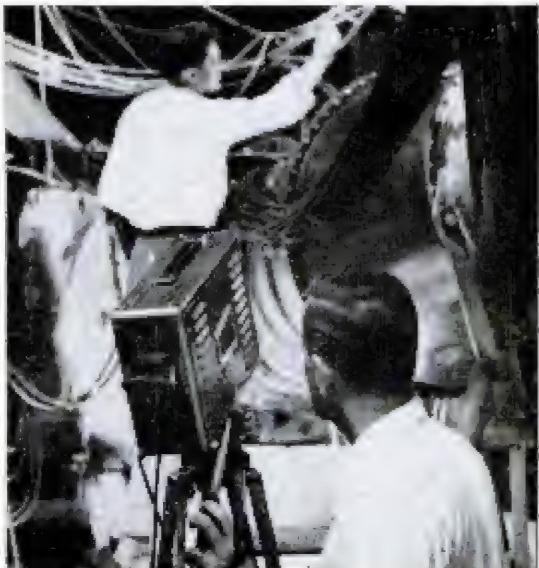
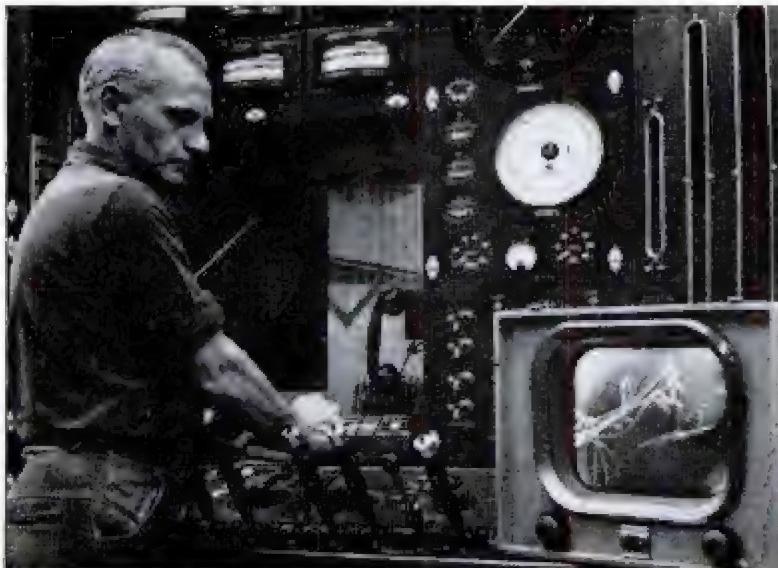
Architects who designed the newly opened United States Embassy in Brazil followed the latest trends in South American building. The \$2,800,000 structure is completely air-conditioned and contains 27,000 square feet of glass. Its most striking

features are a balcony, which surrounds three sides of the top story, and the balcony roof perforated by huge portholes to permit the entrance of sunlight. From the balcony is afforded a full view of Sugar Loaf Mountain, Copacabana Beach and Rio harbor.

TV Cameras Help Engineers Test Jet Engines

Specially built television cameras are enabling engineers to test new jet engines without being exposed to ear-shattering blasts and intolerable heat. They can now follow the trials from a remote point on a standard screen. Equipment designed at the Pratt & Whitney engine plant carries a distortion-free picture as far as 1000 feet over a coaxial cable only $\frac{1}{4}$ inch in diameter. Positioned inside the test cell, the

camera furnishes the engineers with visual proof of the functioning of various parts of an engine, previously hidden from view. Test records can be made permanent by focusing a motion-picture camera on the receiving screen. The camera operates on a closed circuit and does not have an antenna. Banks of ordinary fluorescent tubes are for shadow-free lighting of the parts being televised.



WHAT'S NEW FOR

Your Home



1



2

3

4



1. SEWING MACHINE looks like another kitchen cabinet until it is opened and machine table slides out. Idea is that kitchen is a more convenient place to work, is easily cleaned. On washdays, the sewing can be done right beside washer. The wooden cabinet has storage space, is painted to match kitchen surroundings

2. SAFE MOUSETRAP can be set with one hand, is dangerous only for mice. To set the trap, you just press top together with two fingers. Bait is placed in the bottom between jaws. To dispose of the mouse, you just tip the trap and open jaws by pressing the top together, and the mouse drops out. It even traps mice without bait

3. FLYTRAP is easily baited and as easily emptied, is neither bulky nor an eyesore. Raw meat or fish is placed in the jar, a small amount of any insecticide added and top screwed on. Once flies are trapped, they become dazed and soon die. Placed on a sill or on the ground, the trap is emptied when half full and reset

4. STORM-WINDOW KITS allow you to assemble your own combination screen and storm windows at reduced cost. Everything but glass and screening is supplied with the kit for quick assembly. Both redwood and aluminum models have panel inserts which slide out from the inside, making window washing and seasonal changes easy



5

5. EASY-THREADING NEEDLE has a tiny slot cut into the top of its eye. The thread is bent over this slot and pulled gently until it clicks in. Once in place, the thread cannot come out during sewing. The needle is so efficient that it is said to have been successfully used under the worst lighting and vibration conditions

6. PLUG-IN TIMER turns appliances on or off. When appliance is plugged into one outlet, it automatically turns on at the preset time; the other outlet turns it off at the time set. The device has a range of 20 hours and may be used for controlling air conditioners, room heaters, and other home and industrial equipment

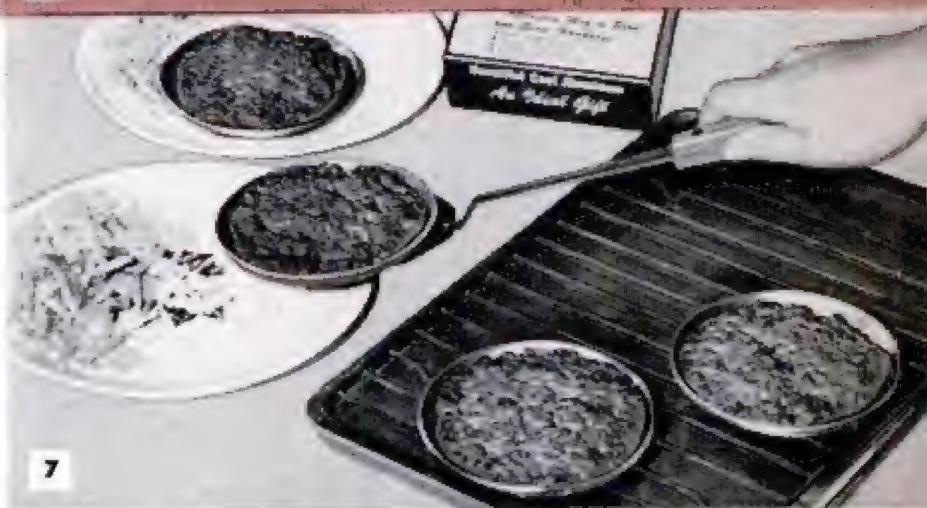
7. HAMBURGER TRAY lets you cook and serve 'burgers on individual platters without once turning them. Meat is placed on platters, which are put on tray and cooked in the broiler. Piping-hot patties retain all their natural juices, producing better flavor. The aluminum platters rinse clean and broiler remains spotless

8. THREAD HOLDER keeps 14 spools free from tangling, makes a handy dispenser. Thread is simply pulled through its slot to desired length and then pulled against a stainless-steel blade which snips it off without fraying. Made of clear plastic, the holder keeps thread in view, making it unnecessary to search for various colors

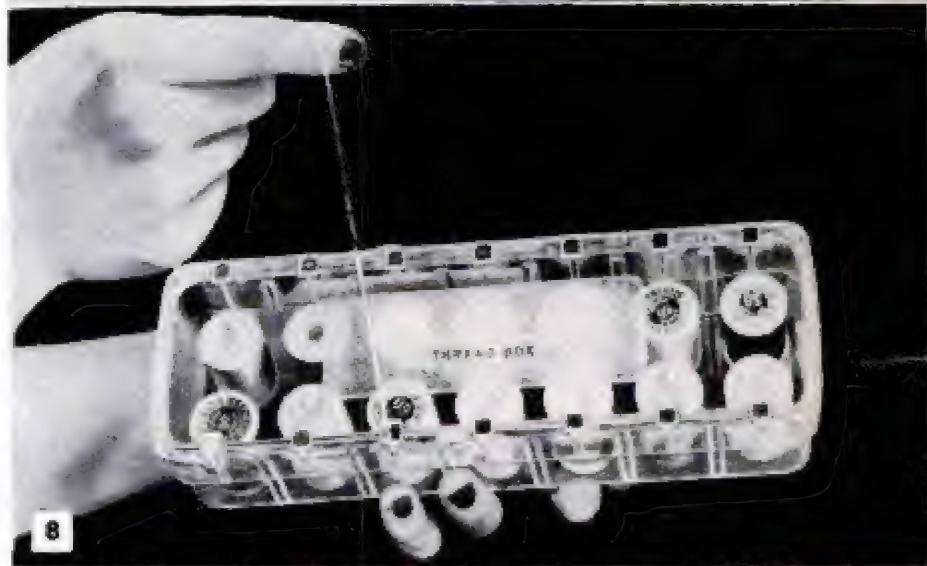
9. CHILDREN'S BUNK with slide attached is popular with youngsters, gets them off to a lively start in the morning and keeps them busy on rainy days. Shelves below slide hold toys next to bed. Firmly attached to side of bunk, the slide is safe and sturdy, well made, and offers children an inducement to go to bed. Ladder is included



6



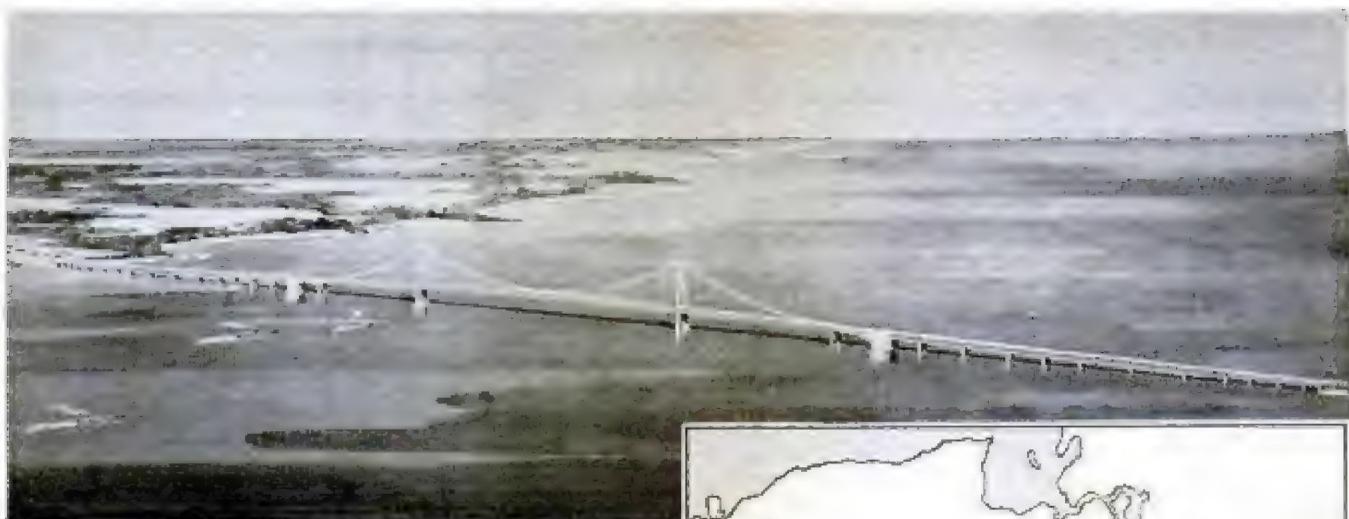
7



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9



Mackinac Bridge Will Rival Golden Gate

Second only to the Golden Gate bridge in tower-to-tower span, a proposed suspension bridge and its approaches will connect the upper and lower peninsulas of Michigan across the Straits of Mackinac. Distance between its two 565-foot towers will be 3800 feet, 400 less than the San Francisco bridge, though the distance between cable anchorage points will be longer—8614 feet. Approach viaducts will be supported by 34 concrete piers heavy enough to resist terrific ice pressure and varying in depth from 50 to 200 feet below water level. The bridge will clear the water by 20 to 84 feet under the approach viaducts and 135 to 150 feet under the main span. With approaches,



the four-lane bridge will be five miles long, will eliminate the present ferries and cut crossing time from 53 minutes to 10 minutes. Costing approximately \$95,000,000, it is scheduled to be finished Nov. 1, 1956. Toll charges are expected to pay for the structure in 20 years.

Researchers Use Ultrasonic Probe to Test Blood Clotting

New hope for victims of bleeding disorders, coronary attacks and other illnesses in which blood-clotting time is important is promised as medical researchers use ultrasonics to measure clot formation. The in-

strument used is an ultrasonic probe that provides scientists, for the first time, with a means of instantaneous, automatic and continuous measurement of the clotting time of blood.

Power-Steering Attachment Goes on Tractor in an Hour



It takes only an hour for a mechanic to install a power-steering unit on a Farmall tractor. The attachment, consisting of a hydraulic pump mounted near the magneto and a power unit mounted on the steering shaft, enables the operator to turn a tractor with but one pound of pull on the steering wheel. Not only does the mechanism eliminate wheel tugging, it also is expected to reduce accidents by eliminating wheel shock and backlash. It costs \$180 plus a small installation charge. Production is now concentrated on units for the Farmall M and H tractors.



Concrete mixture in various tints, representing Nature's own colors, is poured into sections of rubber mold

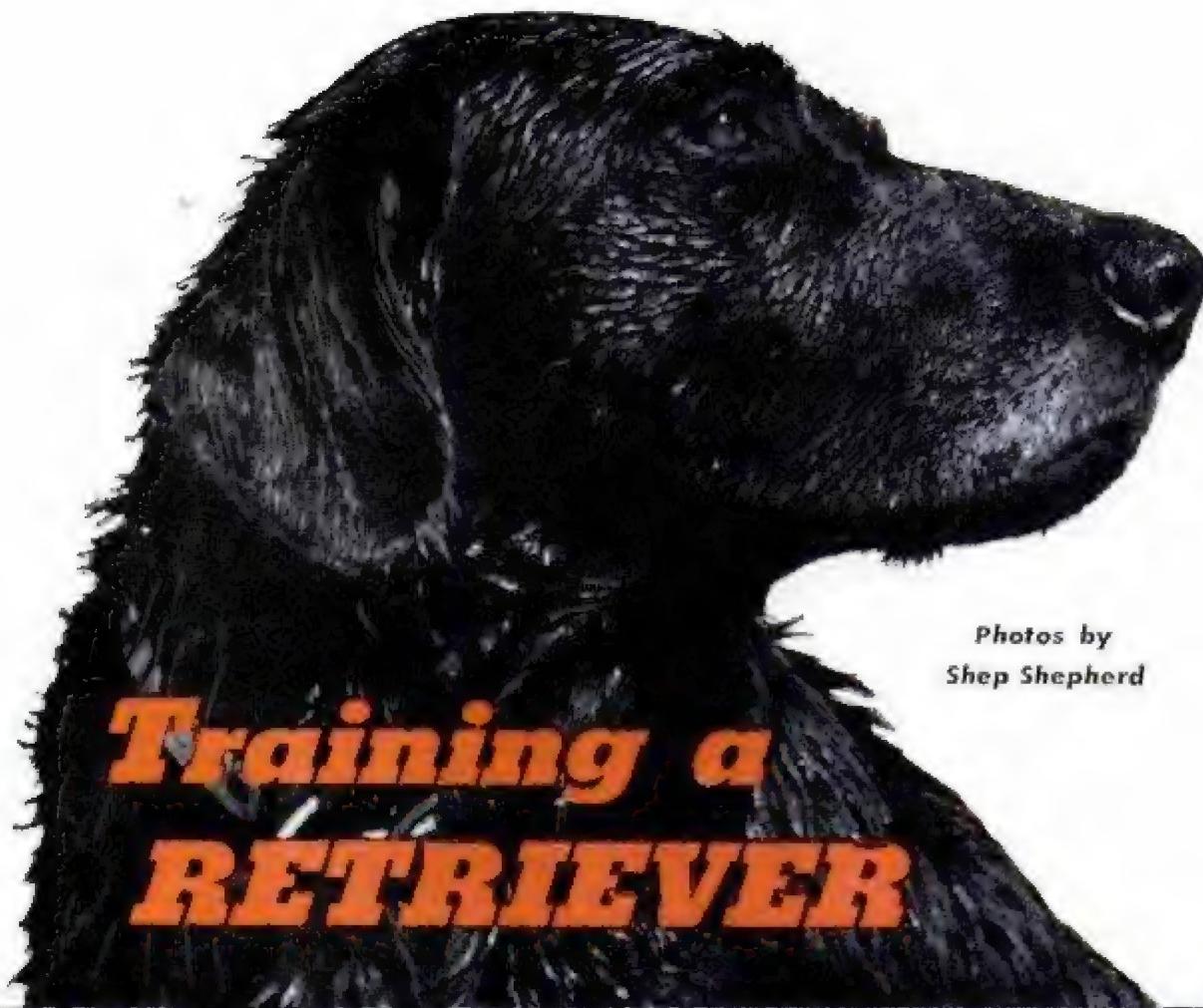
Blocks of 'Flagstone' Cast in Concrete

EVEN A STONEMASON, only a few feet away, would have trouble distinguishing a new imitation flagstone from Nature's own product. Glenn Davis of Phoenix, Ariz., who developed the facsimile flagstone, uses Nature as his model. Davis cuts real flagstone into various shapes and lays the pieces out in a pattern. He then spreads a synthetic rubber over them. When the ma-

terial hardens, he has a flexible mold with the surface texture of the original stone. The mold is placed in a press and Davis pours a concrete mixture, tinted in various colors, into the sections. A mixer then dumps more concrete into a block form atop the mold. The result is a precast section of eight or nine "flagstones." The ends of these sections are lapped.

Mold has surface texture of real stone. Right, ends of each section are lapped, making them easy to lay





Photos by
Shep Shepherd

Training a **RETRIEVER**



OWNERS of Labrador retrievers might well take some pointers from John Kerr of Los Angeles, who works exclusively with the big black dogs and has developed his own training system. Kerr starts working the pups when they are only four months old. He uses an older, well-trained dog as a helper in teaching the youngsters, for he figures a pup learns much just by observing and accompanying an old-timer. He also uses tame mallard hens, carefully wrapped in canvas jackets, to help in teaching dogs to retrieve. Surprisingly, the ducks love their work!

★ ★ ★

Right, big Labrador has such a soft mouth it delivers three eggs without cracking them

1. As training aid, Kerr uses duck wrapped in jacket that holds wings but leaves feet free for swimming. 2. He tosses duck into water, firing pistol just before it splashes. Then he holds dog until he commands "Fetch!" 3. Lad, a well-trained dog, makes quick retrieve while pups watch. Pups learn much by watching old dog work without fuss or waste motion. 4. Lad never lays bird down but brings it straight to Kerr



3



5. Kerr straps four-month-old pup to Lad. Pup then must go along on retrieve whether he wants to or not. 6. Pup is given sniff of bird. With young dogs, Kerr uses canvas-clad pigeons in place of heavier ducks. 7. On command, Lad takes off for retrieve, towing an unwilling pup behind him. Lad is so powerful, pup has no choice. 8. On way back, pup swims side by side with old master and proudly helps deliver the bird



4



7



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1



2



Though mouth is soft, jaws can lift steel chair

Kerr points out that soft stick with wheellike ends for good grip can be used in place of birds



3

1. Pup is ready for his first retrieve alone. Bird is thrown and the pistol fired. Kerr holds pup in place until he gives command. 2. First retrieve is a short one—to just about wading depth. Kerr recommends starting pups as young as possible, before they pick up bad habits. 3. Lad watches critically as pup brings bird





Protective plastic strip, easily applied to edge of automobile door, ends one cause of parking-lot scratches

Plastic "Bumpers" Protect Edges of Automobile Doors

Plastic strips which fasten to the edges of car doors are designed to guard against chipping, rust and door rattle. It takes only

a few seconds and requires no tools to clip on the strips. Durable and fadeproof, they are made to fit any make and color of car.

Living-Room Grass Plot Adds Outdoor Atmosphere

Grass and a banana plant add an outdoor atmosphere to the living room of Joseph F. Gordon, a Dallas, Tex., architect. Gordon built a glass enclosure to include the greenery, formerly part of a screened porch, within his living room. Now he mows the fast-growing living-room grass while his wife vacuums the rug.

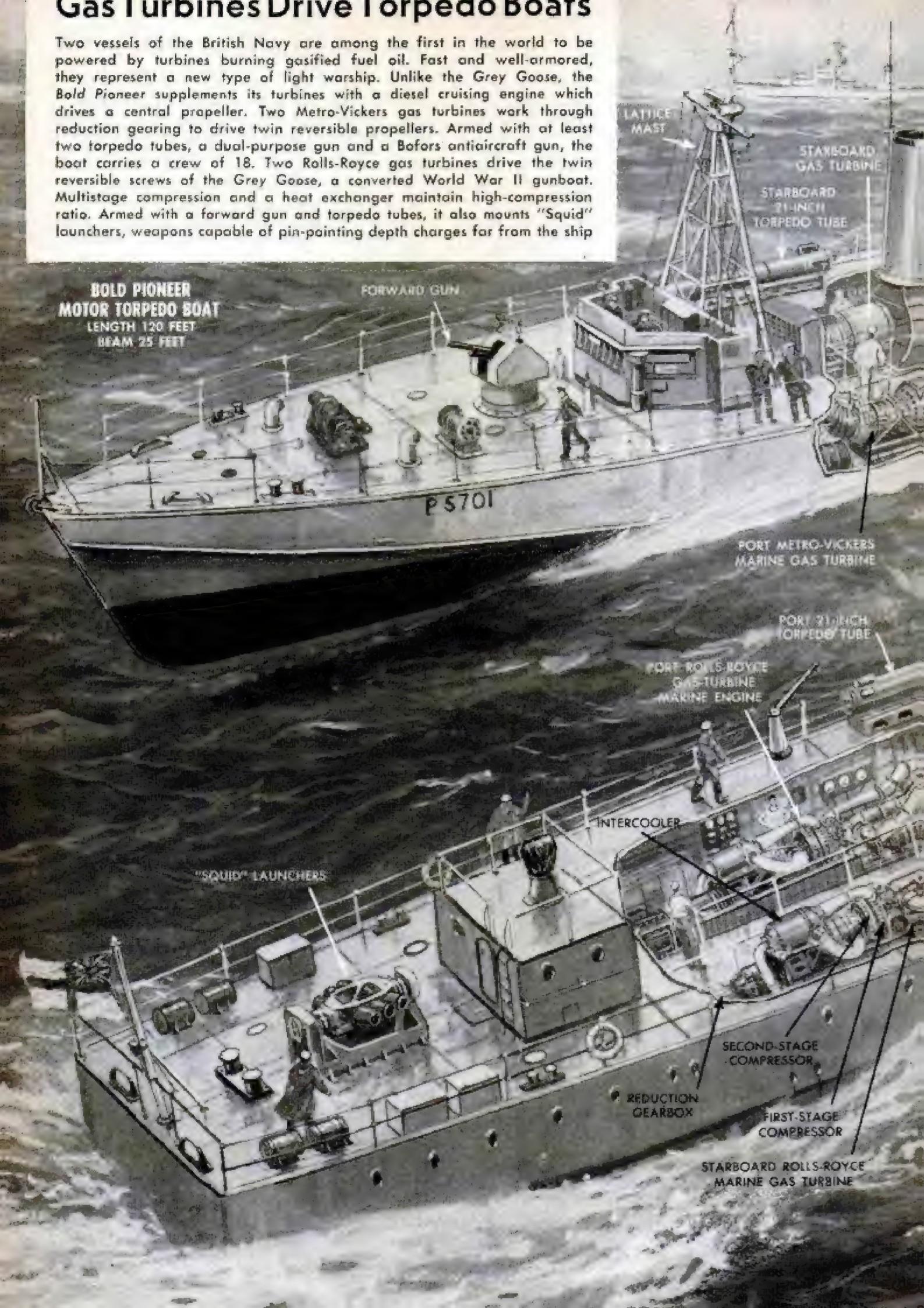
U. S. Steel Industry Leads World

America, with a steel capacity of 117,500,000 tons, is far ahead of any other nation in the world both in the production and consumption of steel. During 1951, according to estimates published by the American Iron and Steel Institute, the United States consumed 1347 pounds of crude steel per person, Canada 805 pounds, Sweden 710 pounds and the United Kingdom 611 pounds. The U.S.S.R., with a total steel capacity of about 35,000,000 tons, consumed 342 pounds per capita.



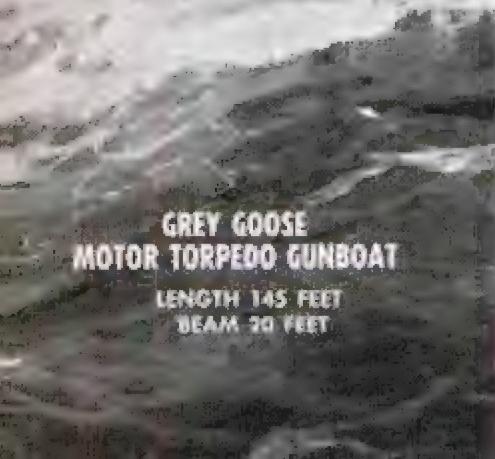
Gas Turbines Drive Torpedo Boats

Two vessels of the British Navy are among the first in the world to be powered by turbines burning gasified fuel oil. Fast and well-armored, they represent a new type of light warship. Unlike the Grey Goose, the Bold Pioneer supplements its turbines with a diesel cruising engine which drives a central propeller. Two Metro-Vickers gas turbines work through reduction gearing to drive twin reversible propellers. Armed with at least two torpedo tubes, a dual-purpose gun and a Bofors antiaircraft gun, the boat carries a crew of 18. Two Rolls-Royce gas turbines drive the twin reversible screws of the Grey Goose, a converted World War II gunboat. Multistage compression and a heat exchanger maintain high-compression ratio. Armed with a forward gun and torpedo tubes, it also mounts "Squid" launchers, weapons capable of pin-pointing depth charges far from the ship.



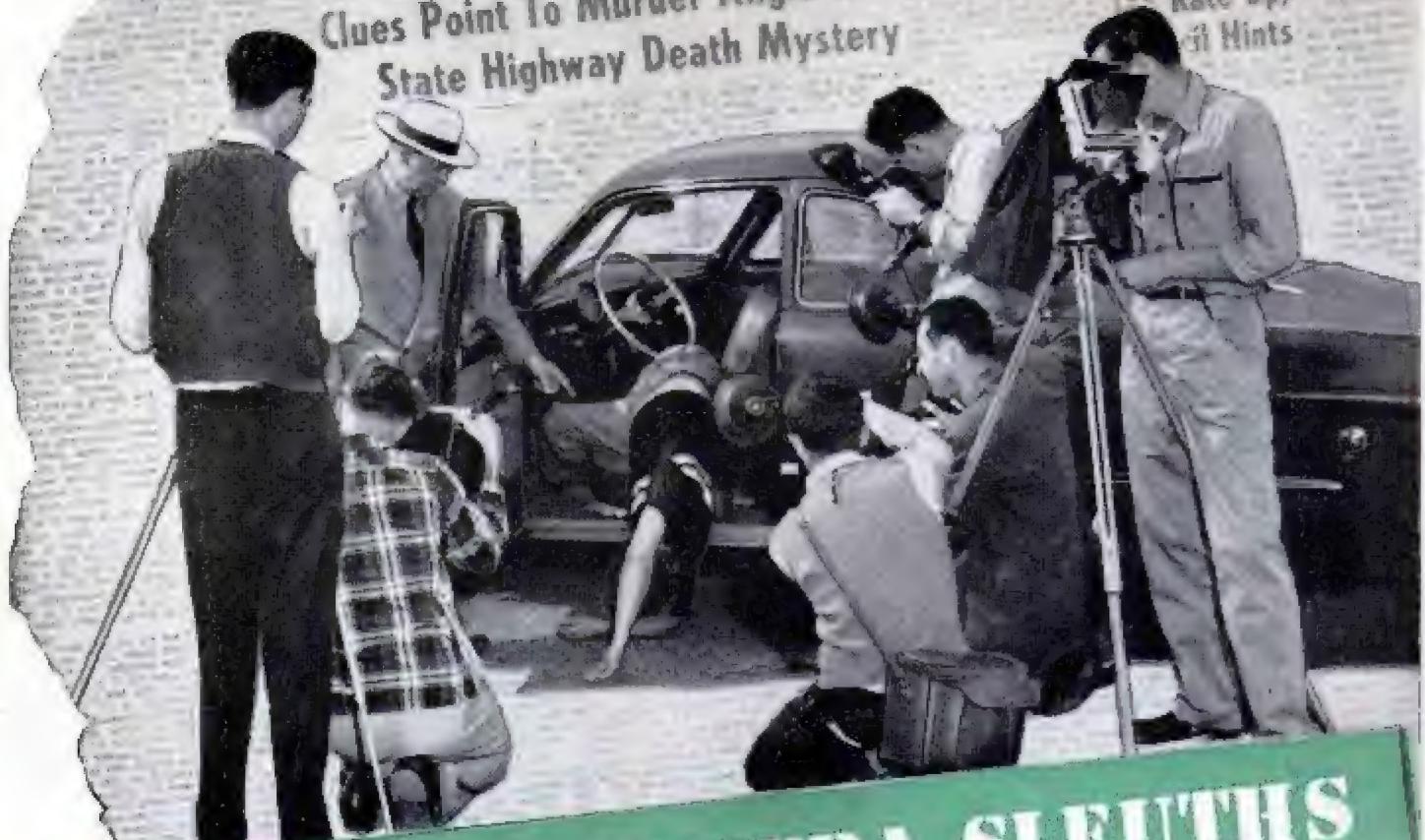


Bold Pioneer runs through tests. Speed of fast torpedo boat is secret



Clues Point To Murder Angle In
State Highway Death Mystery

Rate Up,
With Hints



SCHOOL FOR CAMERA SLEUTHS

Murder or suicide? Students aim their cameras as they try to find out. Each takes a turn at playing "victim"

By Lou Jacobs, Jr.

WHEN PATROL CARS race to the scene of a crime and police pile out with guns drawn, not far behind is the official photographer to record evidence that may mean guilty or not guilty to some suspect months later.

What makes a good crime photographer? What are his problems? In Santa Barbara, Calif., the Brooks Institute of Photography specializes in training for police work. Students set up their own crimes or accidents and "solve" them photographically. They learn to track down evidence with lens and shutter.

There are plenty of angles to using the camera in detective and legal work. Perhaps the most familiar are the pictures taken at the scene of an auto wreck. Police photographers arrive on the spot to get pertinent details of the incident in black and white or color. They have to know where to focus, what kind of lighting to use, and often how to outwit criminals who don't intend to be caught. In eight months at Brooks (with basic photo knowledge as a prerequisite) the student learns to track the slimmest evidence down the narrowest alleys with some fascinating versions of

the box camera as his faithful "Watson."

For instance, did you know that burglar-tool marks could be photographed and matched with the suspected instruments? In the same way footprints, obliterated serial numbers, arson fragments and fingerprints are recorded for use in court or by law officers. Students learn the use of a simple fingerprint camera, a long black box that uses high-contrast film and has a self-contained lighting unit set at a flat angle to pick up the texture of faint prints. The two-inch-square negatives can be blown up to 11 by 14-inch prints that can be used for critical matching.

In ballistics, the students learn to photograph rifling marks on bullets through a comparison microscope. To photograph the faint remaining impressions of a serial number that has been obliterated from a gun or motor block, they learn to heat it and polish it with fine emery. The grain of the metal is finer where it has been stamped and often identifying marks will appear for waiting lenses.

There is a classroom course in infrared, the film that uses an invisible flash from a bulb. Crime investigators who must re-

main undetected to avoid suspicion find infrared photography a useful tool in the dark.

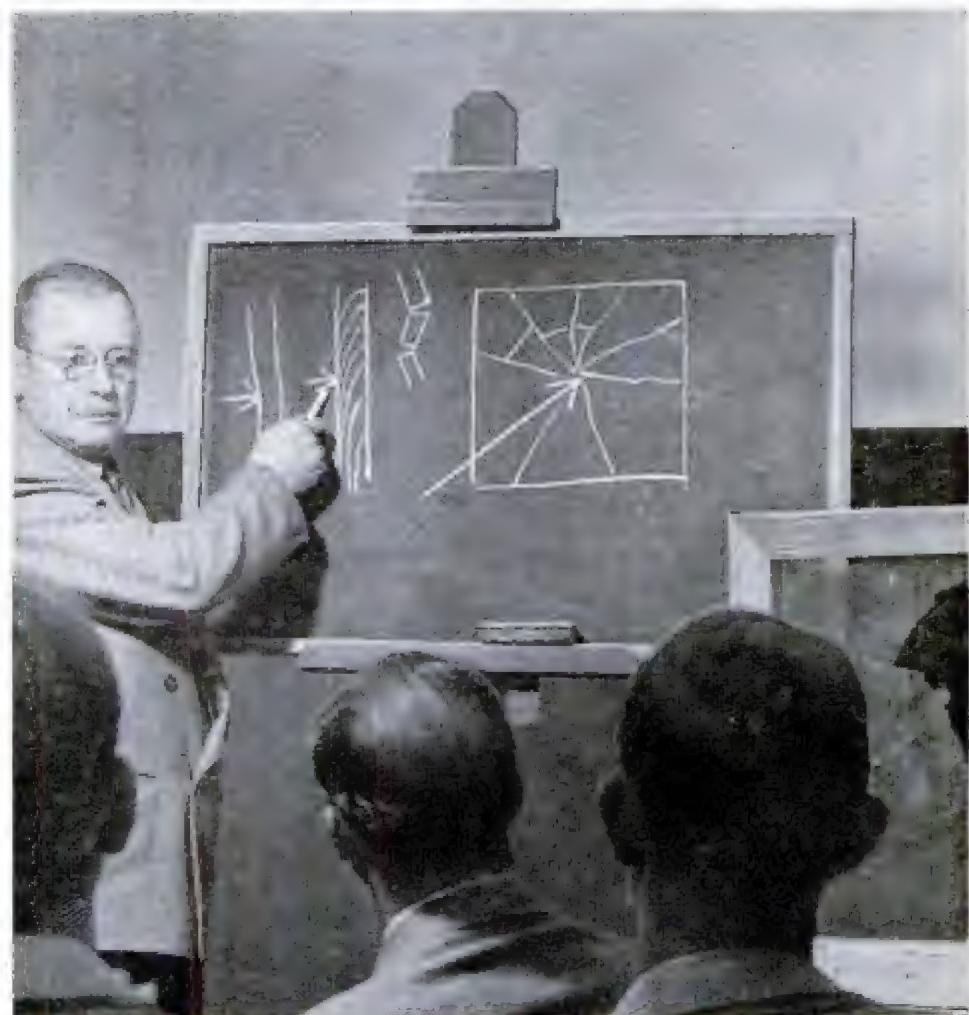
Questioned documents and secret or hidden writing get a going over in the course. A student will be handed an ordinary business letter and told to examine it for evidence. Using infrared light he may find a secret message written in the paper between the typewritten lines. Or he may have to decide by copying the letter and comparing it with other printed matter which typewriter it came from. Other tricks are used with charred documents when infrared light or high-contrast film may bring out illegible writing. Ultraviolet light is a neat tool for photographing ink marks that have been erased from a contested will or letter.

Richard A. Addison, who directs the investigative photography courses at Brooks, is a former police officer. He believes in plenty of location work for his classes.

Borrowing a "victim" from among the student body, Addison will simulate an accident or crime on an open road or perhaps in a living room. From his experience he knows what to leave as evidence, how to upset furniture, where to leave fingerprints, how to hide telltale marks and how to make an accident that may have been deliberate look innocent. The class then descends on the scene, scanning it carefully and touching nothing. With their cameras, the students record over-all and



Above, students learn to tell the sequence in which bullet holes were made in windshield and, below, from which side of the glass came the force to break it





Bullets are fired into a recovery box and rifling marks photographed for matching with those of murder gun

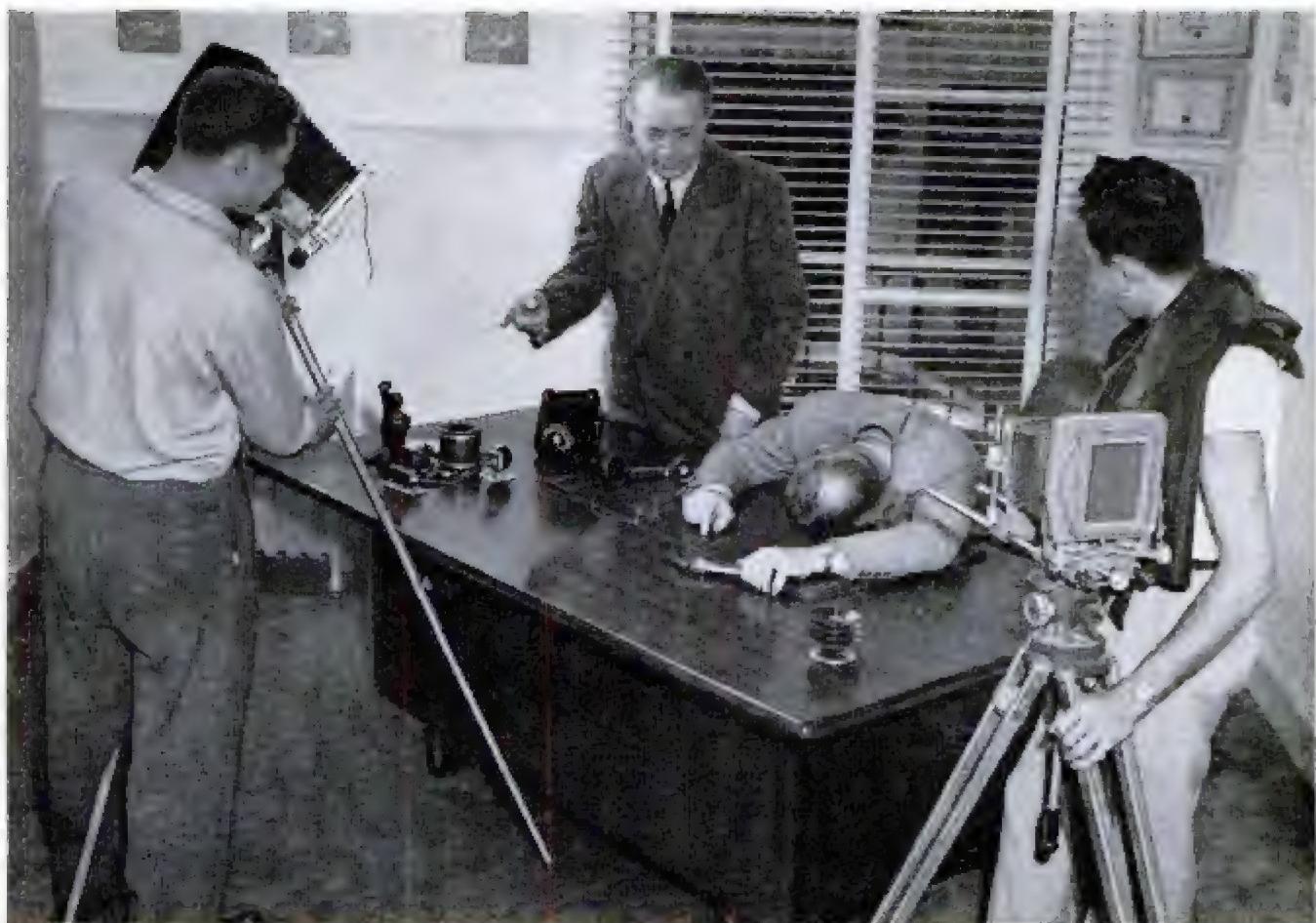
Camera on a microscope photographs bullet rifling



individual details. Addison tries to deceive, but they soon learn to probe beneath the surface of a scene well enough to qualify as camera detectives. When the body, the automobiles, the weapons or the fragments of the scene have been lighted to bring out their position and textures, photos are made. Addison may point out mistakes and omissions and with such field work his students get accustomed to coordinating with police or lawyers as in actual practice.

Another phase of picture-taking finds students with their movie cameras making traffic-surveillance records. Recently a suburb of Santa Barbara discovered that a particularly hazardous street corner had too many accidents. Three students stationed themselves to get over-all and telephoto shots both night and day. They made a motion picture of how cars and pedestrians reacted. Back at the labs they developed and reversed the film themselves, a skill that would come in handy later, for they will be able to testify in court that the film shown as evidence had never left their hands. The movie, when edited and shown to local authorities, had such impact that the streets were widened, curbs were altered and safety zones designed to fit that particular intersection. Photography had pinned down the accident story.

Those same movie cameras might also be used to gather evidence without the subject's knowledge. Students get acquainted with skillful concealment in cars or trucks,



All crime scenes are carefully posed and photographed just as an actual situation would be by police experts

or behind a two-way mirror, transparent only from their side.

Along with photography, students get a course in writing reports. "No matter how many hours of agony the pictures took, they are not much good unless plenty of written information is included with them," says Addison. "We use standard police forms, plus one that I devised which is intended to get all caption data from the camera reporter who was on the scene. If they are going to be detectives, they must know how to make their picture evidence stick."

Some Brooks assignments can be exciting but, on the other hand, there are routine assignments such as photographing cracks in a sidewalk, copying forged checks or making identification pictures. For the latter, Brooks has a Strob outfit similar to the latest used in metropolitan police departments. Bloodstains, human hair, wounds, plus the other types of evidence mentioned are tackled with specialized filters.

film and equipment. After a footprint is photographed, students learn to make a plaster impression of it so that their full-size photoprint will have the added backing in court of a three-dimensional model.

The ethics of legal photography are strongly instilled into his students by

(Continued to page 218)

Photographers learn to preserve evidence with the camera for use in the courtroom. Here a student builds up a case against a suspected arsonist



HAY BALER 'PACKAGES' COTTON



ENTERPRISING farmers of Pahrump Valley in Nevada are using an ordinary hay baler to compress cotton in the fields before it makes the journey to the gin. The resulting bales are easy to handle and pack into trucks, and experience has shown that the seeds cause no damage. When the mechanical picker has a full load, the operator dumps it in a hopper above the baler. Then while the picker gathers more cotton, the baler empties the hopper for the next load. The bales are lifted to the big semitrailers by a homemade loader attached to a small tractor. Conventional loaders would not lift the bales high enough, so one of the farmers built a rig to do the job. It is easily attached to a small tractor. By loosening a few bolts and disconnecting the winch cable, the farmer can remove the loader and use the tractor for other farm chores. The cost of the loader, which was built from scrap metal, was approximately \$50.

When mechanical picker arrives from the field, the operator dumps his load of cotton into hopper built above the baler. Hopper holds one full picker load. While picker gathers more cotton, the baler empties the hopper

Hay baler turns out tightly packed bales of cotton



Ingenious farmer built this rig for lifting the cotton bales to the beds of semitrailers. Conventional loaders wouldn't lift high enough. Built from scrap, the loader cost about \$50



Pocket-Size Wire Recorder

PERHAPS one of the most sensational units to appear on the wire-recorder scene recently is a complete battery-operated recorder, $6\frac{3}{4} \times 4\frac{3}{8} \times 1\frac{1}{2}$ in. in size. It records, erases and plays back through a pair of lightweight earphones.

The entire recorder fits any average-size pocket, or it can be carried and operated in a fabric shoulder-type carrying case, as illustrated in photo A. Two types of sensitive miniature crystal microphones are available, as shown in photo D. One is a lapel variety and the other is a wrist-watch type worn by the operator in photo A, for making concealed recordings useful in detective work and for checking comments in crowds at shows and similar applications.

This Minifon recorder, made in Germany, is now available on the American market; it is powered with standard miniature A and B-batteries. The motor is driven by a Mallory mercury-cell-type battery pack that sells for \$4.25. This provides 24-hour service. The A and B-batteries last for full shelf life. An a.c. power-supply unit also is available for operating the motor from 110-120 volt a.c. lines. Photos B and C are internal and external views of the recording and playback unit. Recording wire is available in spools providing $\frac{1}{4}$ to $2\frac{1}{2}$ hours of continuous operation.



C



A



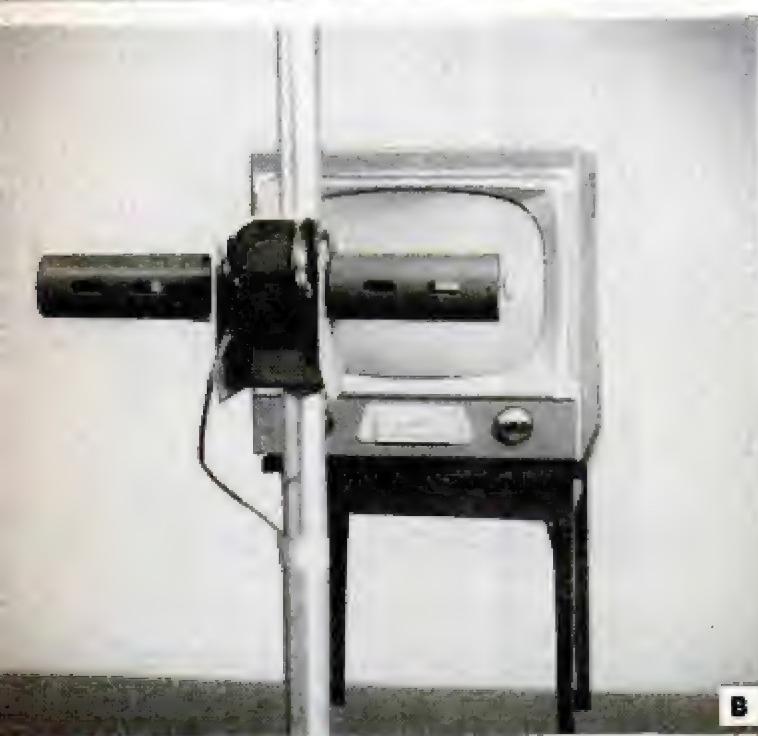
B



D



A



B

THREE-DIMENSIONAL

By Paul A. O'Neal

YOUR FIRST LOOK at 3-D TV will be just as startling and realistic as when you first viewed the new 3-D movies at your local motion-picture theater.

Three-dimensional vision is actually easy to accomplish on television. Whereas in cinematography there are many problems in producing 3-D in large auditoriums, TV can be utilized in a small room and need provide for only a few viewers at any one time. There is no need for using two films and keeping them matched, and no wide-angle screen or throw-away Polaroid glasses are required.

Actually, in TV we have to provide only a simple system whereby basically the images come alternately from the left and the right lens at the transmitting station. This may be accomplished by using any efficient system of optics which will put an image from one lens on the TV-camera plate immediately followed by the alternate lens image, or it may be accomplished with two television cameras switched electronically.

In any event, the two lenses should be approximately as far apart as the human eyes. It is desirable to make the image not only appear to have three dimensions in the television receiver, but also to make it protrude out of the screen so the announcer

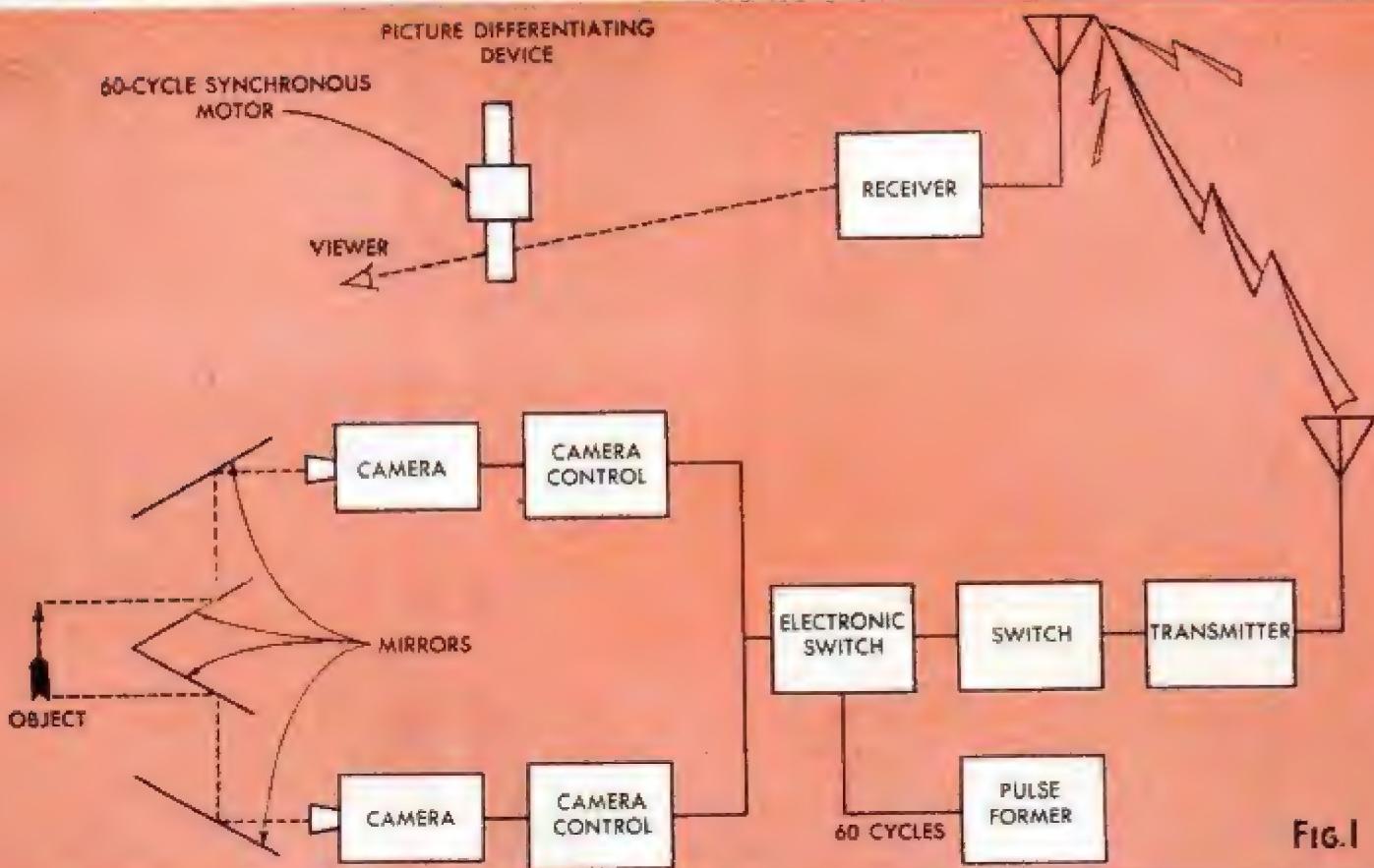


FIG. I

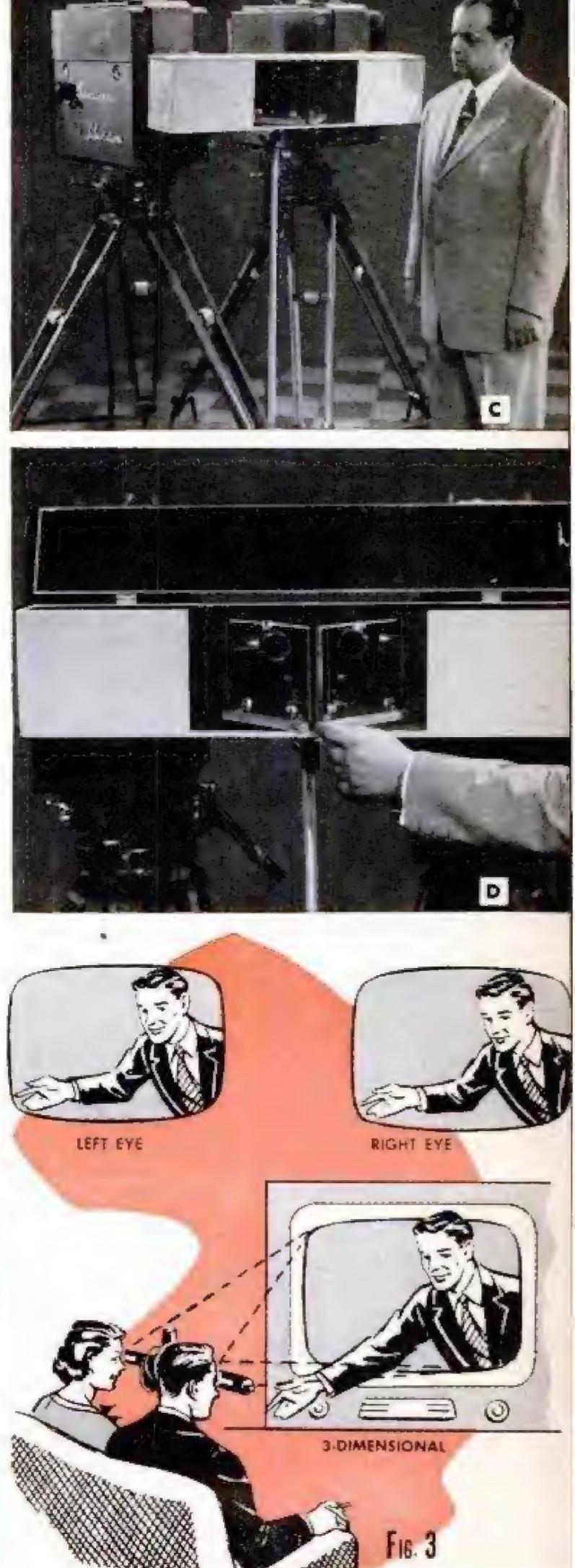
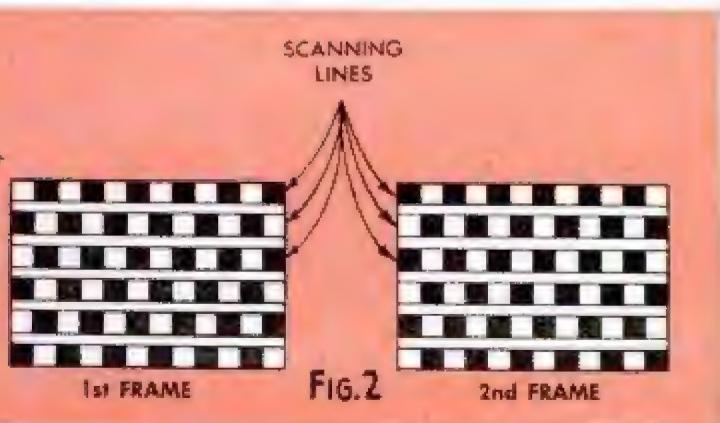
TELEVISION SYSTEM*

seems to hold his hand out into the room. This startling illusion is illustrated in Fig. 3. You have the desire to shake hands with him, or to reach out and grasp a box of candy that he may offer. This illusion may be exaggerated by having the pickup lenses farther apart than the eyes of the viewer. In the days to come, the expert stereo-TV cameraman will have to know his angles and protrusions.

The principles recently demonstrated by U. A. Sanabria at American Television Inc., involve the basic system illustrated in the block diagram, Fig. 1. A square-wave generator alternately cuts off electronically first one camera, then the other, producing 15 images from each camera. Then these are transmitted in the usual fashion using the same impulses, and nothing need be done to upset the transmitting standards. This studio arrangement with the TV-picture cameras and the 3-D periscope is being inspected and checked by Mr. Sanabria in photos C and D.

At the receiving end, photos A and B, the television receiver does not have to be touched. The picture-viewing device is tubular in form, and the experimental model employs an ordinary magnetic synchronous motor which is used to twirl a little piece of metal called a butterfly. When this flat piece of metal, with a cutout in each alternate corner flops over, it opens the right eye first, then the left one in step with the electric switch at the camera end. Since all TV stations are local, the ordinary 60-cycle power system will be adequate for general use.

Mr. Sanabria states that it is possible to utilize many tricks to eliminate the mechanical "lorgnette," and suggests a checkerboard system of Polaroid, Fig. 2, having a right and left alternate series of checkers, and then using interdots at the transmitter to correspond with every other image. Then, with ordinary Polaroid spectacles, no moving parts have to be used. ★★★



HAMS BOUNCE SIGNALS OFF THE MOON



QST photo

A N AMATEUR radio signal has been sent to the moon and back, at last. "Project Moonbeam" is a success after three years of trying by a few enterprising and infinitely patient hams.

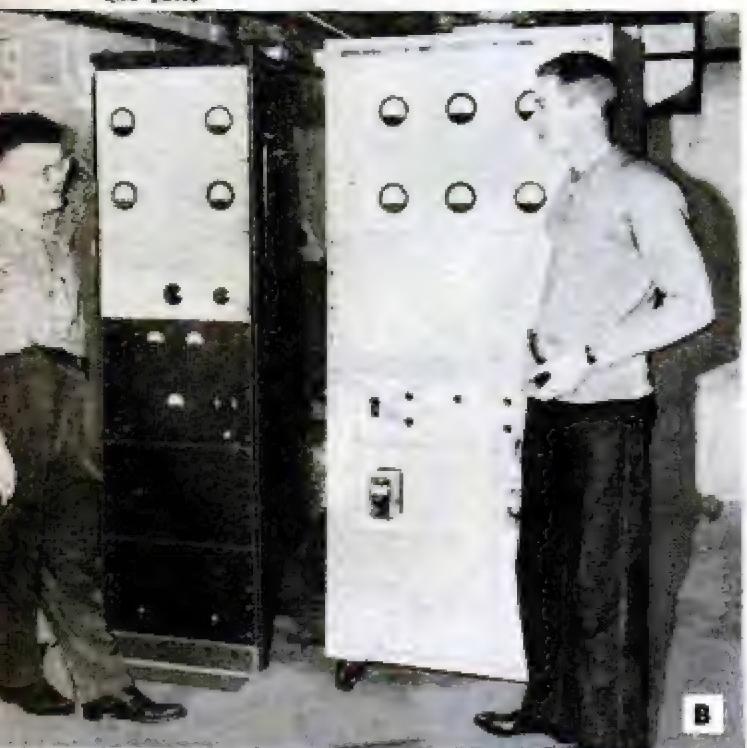
Listening to the wire recording from which the graph, Fig. 1 below, was made, it would not be very impressive to the uninformed casual listener. Just a one-second "beep," an interval of receiver noise, then a wavering, trailing bee-e-e-e-p barely discernible in the midst of musical rushing sounds that are characteristic of high-selectivity reception. But to Ross Bateman, W4AO, and Bill Smith, W3GKP, it was music of the sweetest sort; all those long hours of figuring, thinking, building, rebuilding and testing were not in vain.

Bouncing signals off the moon is not new, of course. It was done on 110 mc. by the U. S. Signal Corps in 1946, and some lunar signal-bouncing experiments have been conducted between Cedar Rapids, Iowa, and Washington, D. C. These high-power projects, however, and their slim margin of success, indicated that lunar DX was a long-chance proposition for the amateur with his definitely limited power.

It was a goal that just might be achieved, but only after the most painstaking effort, if at all. A roundup of the best available information indicated that it would take the top level of the amateur power limit pushed to the last watt. Obviously, the 144 mc. (2-meter) ham band was indicated for the project. An antenna with a gain of at least 20 db was required, and a degree of receiver performance to tax the ingenuity of the best engineers in the business was called for.

Bill Smith, W3GKP, then of Silver Spring, Md., knew the requirements in a general way and felt sure that the trick could be turned eventually. Another amateur, Ross Bateman of Falls Church, Va., had been working along similar lines and they became co-workers in Project Moonbeam. Ross had the technical know-how and a 2-meter transmitter, photo B, capable of a full and efficient kilowatt, a 32-element array (antenna), a low-noise receiver and a quiet suburban location. Wire copies of tests were forwarded to the American

(Continued to page 228)



B



C

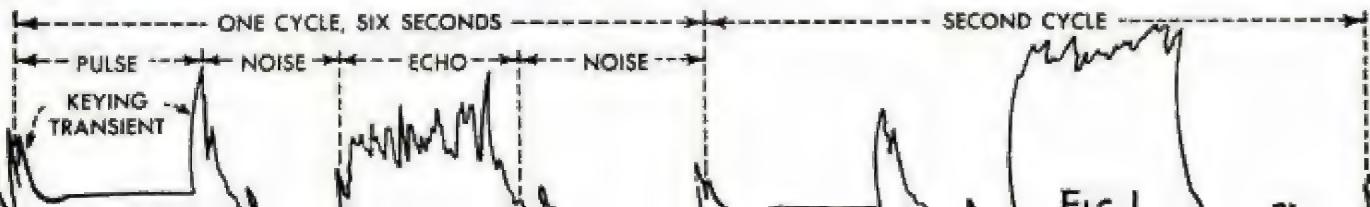


Fig. 1

the POPULAR MECHANICS CRAFTSMAN

TO COMBINE REAL SAVINGS with the satisfaction of building something truly useful, make a set of this attractive luggage one of your fall workshop projects. The matched pieces feature clean modern lines, combining wood with simulated leather to achieve an eye-catching effect, and you will find them extremely easy to build. Each case is built like a box, then sawed apart to separate the lid from the bottom section. The outside is finished, the lid is hinged to the bottom, the hardware applied and, finally, the inside is lined. Essentially, that's all there is to it.

The ends, tops and bottoms of all the cases are made of $\frac{3}{8}$ -in. solid stock. Basswood is preferable, but poplar or gumwood also is satisfactory. The sides of the cases are of $\frac{1}{4}$ -in. plywood

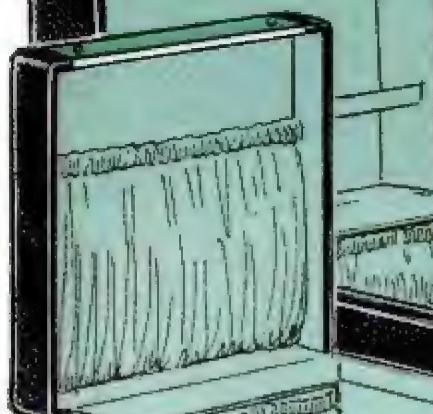
By
John Bergen



Build Your Own *W.M.'s* LUGGAGE



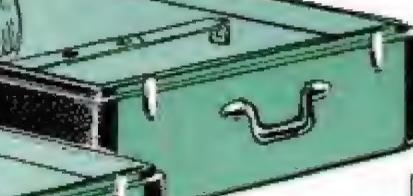
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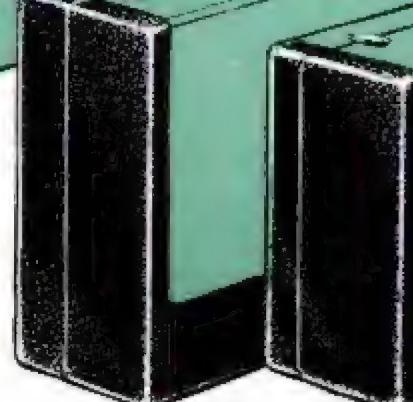
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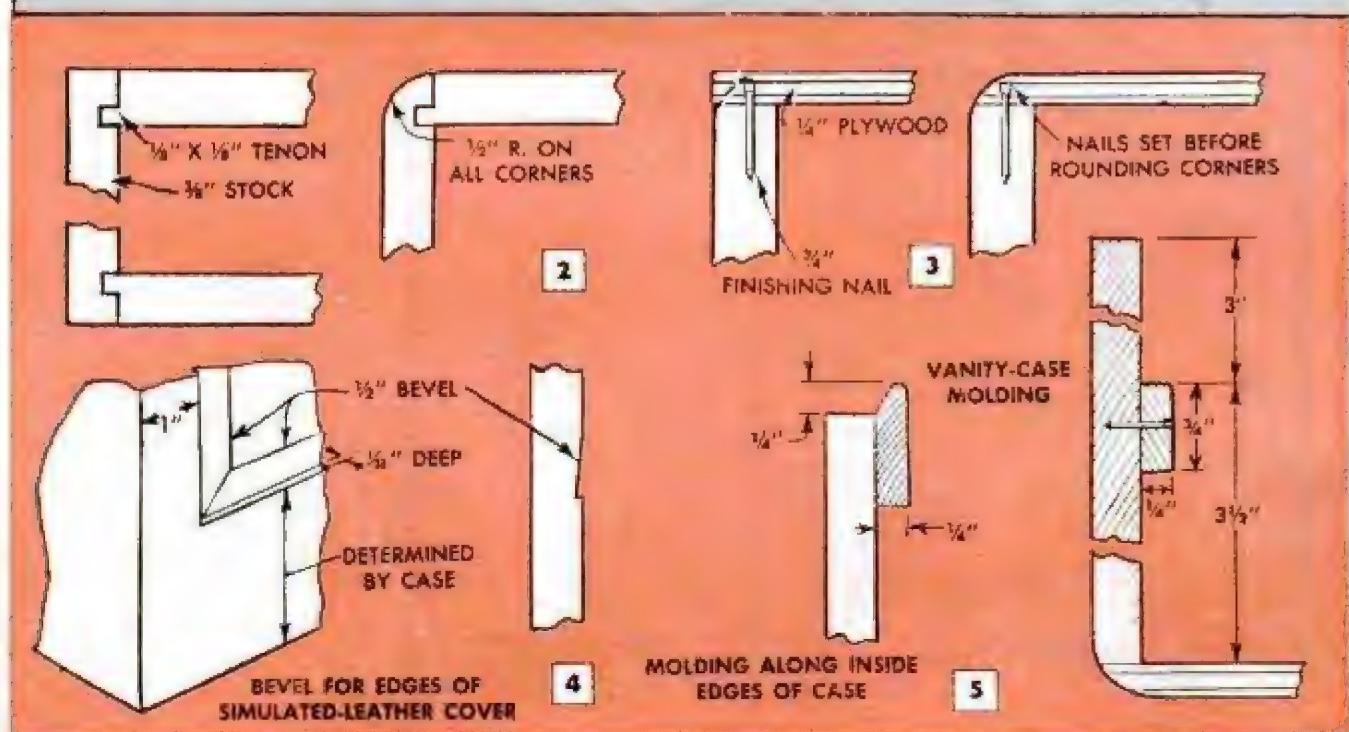
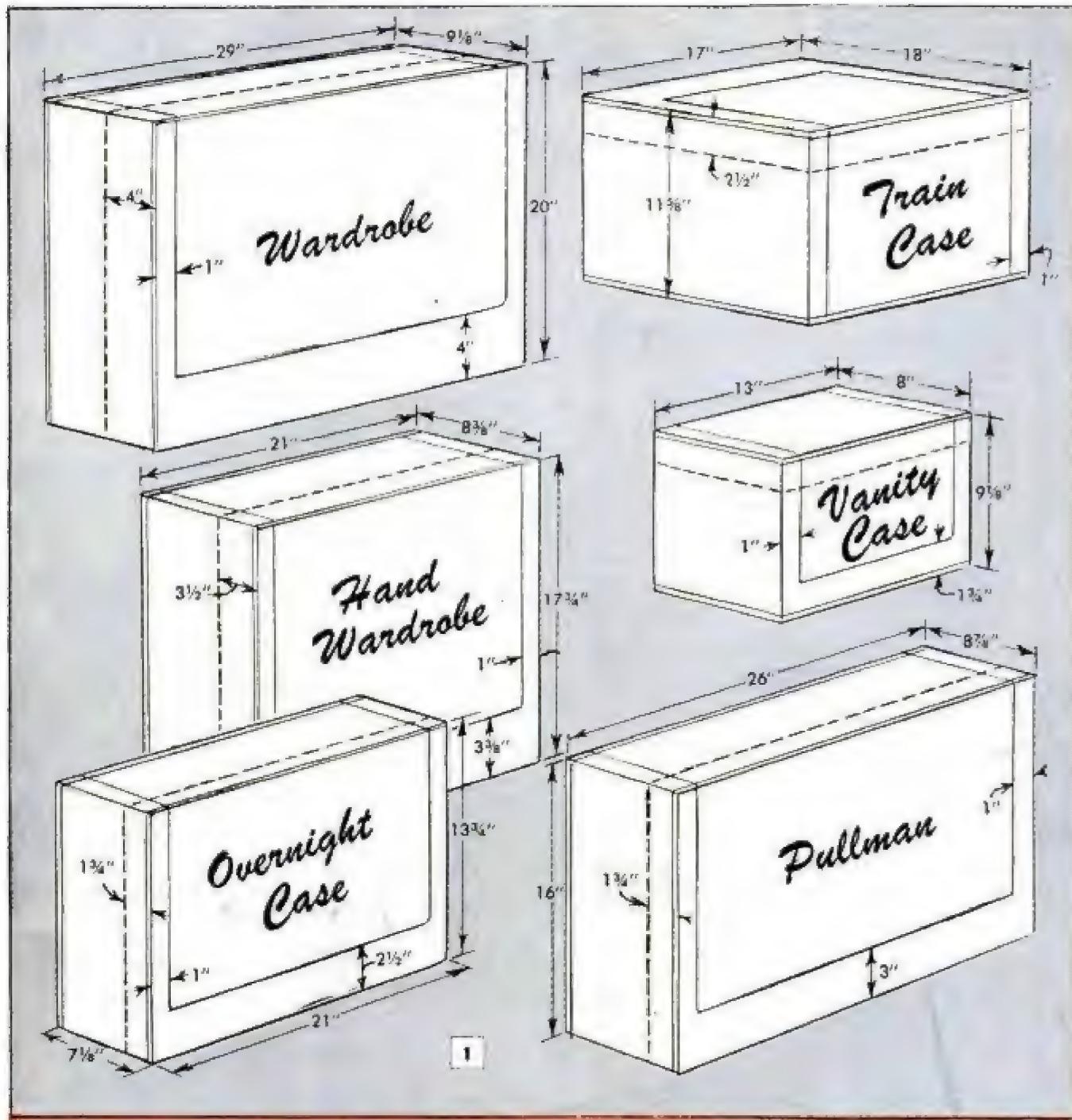


E



F

- A Wardrobe—9 x 20 x 29 in.
B Train Case—11½ x 17 x 18 in.
C Vanity Case—8 x 9 x 13 in.
D Hand Wardrobe—8¼ x 17¾ x 21 in.
E Pullman—8¼ x 16 x 26 in.
F Overnight Case—7 x 13¾ x 21 in.



veneered with the same wood as the solid stock selected. Dimensions of the six different cases are given in Fig. 1. The endpieces are grooved to receive rabbeted tenons cut on the ends of the top and bottom pieces, Fig. 2. The joints are glued together and either clamped until the glue dries or set with finishing nails after checking the case for squareness. The plywood sides are then glued and nailed to the edges of the solid-stock frame, using $\frac{3}{4}$ -in. finishing nails and setting them $\frac{1}{8}$ in. below the surface.

After the glue has dried for at least 12 hours, all corners are rounded to a $\frac{1}{2}$ -in. radius as in the right-hand details of Figs. 2 and 3. This can be done on a shaper or with a plane, being sure that all nails have been set deep enough to clear the blade, and then sanded smooth. The intersections of the corners can be blended to a smooth contour by filing and sanding.

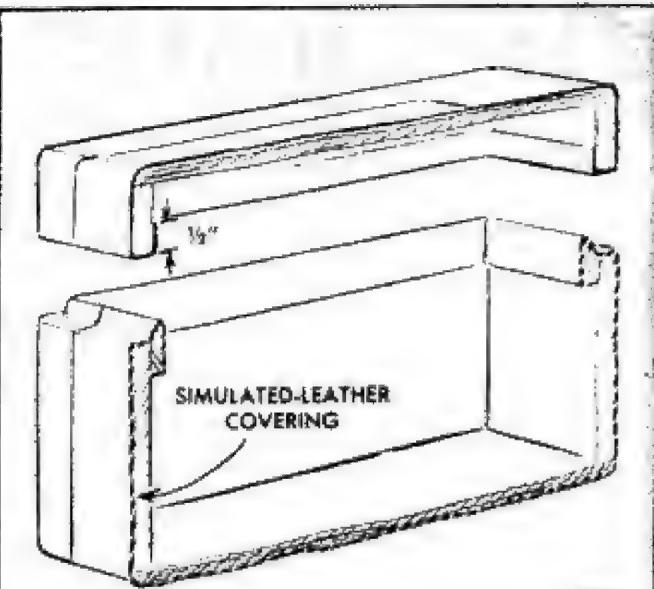
Note in Fig. 1 that the plywood sides as well as the tops of all the cases are scored 1 in. inward from the ends and from $1\frac{3}{4}$ in. to 4 in. from the bottom members, depending on the particular case. A knife is run along all the score lines to make a cut $\frac{1}{2}$ in. deep and a $\frac{1}{2}$ -in. bevel is made to the cut as in Fig. 4. This bevel cut permits the edge of the simulated-leather cover to lie flush with the surface of the case.

The next step is to saw the lid from the body of each case. The circular saw, of course, will do the quickest and neatest job, but a handsaw also can be used. On the circular saw, set the blade for a $\frac{1}{2}$ -in. cut, just deep enough to separate the $\frac{3}{8}$ -in. stock, and set the fence to allow the full dimension on the lid section. The dotted lines in Fig. 1 locate the saw cuts.

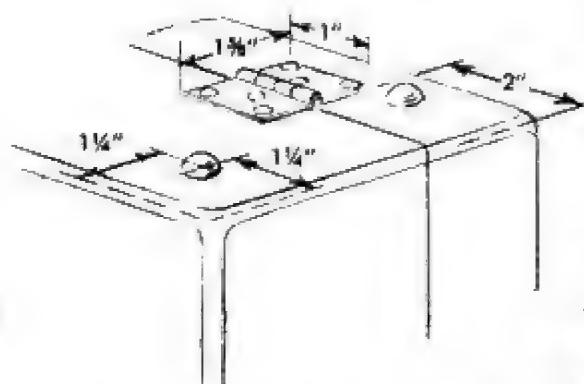
After cutting apart the cases, sand the edges of the lids and bottom sections and clean all surplus glue from the inside surfaces. Then glue and brad the lip molding, left-hand detail, Fig. 5, around the inside edges of the body of each case except the vanity case. The latter is fitted with cleats located 3 in. down from the edge to support a tray. The moldings and cleats should be mitered at the corners.

Any dents and holes in the outside of each case should be filled. Then the entire surface which is not to be covered with simulated leather, including all exposed edges and moldings, is sanded with 3/0 sandpaper. Two wash coats of thinned shellac are applied to these surfaces, sanding between coats with 4/0 paper. These are followed with an additional two coats of enamel in the desired color, again sanding between coats.

The cases are now ready for covering with plastic simulated leather. If you wish, however, natural top-grain leather can be used. For the simulated leather, use either



6

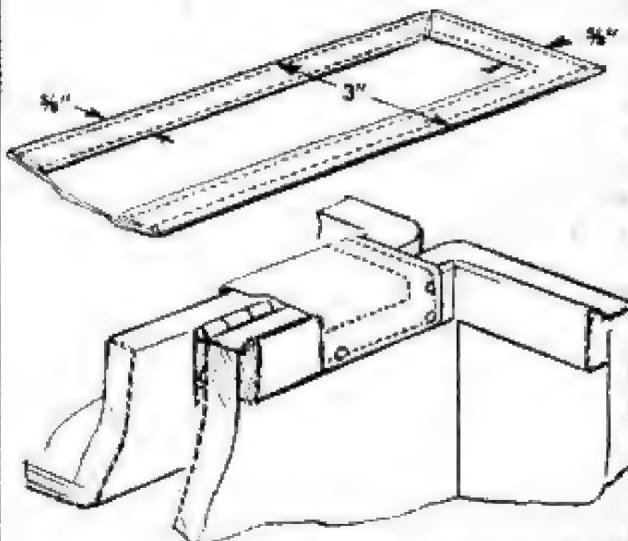


MOUNTING HINGES AND GLIDES

7

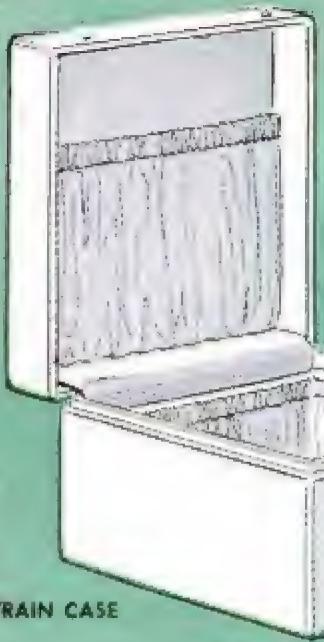


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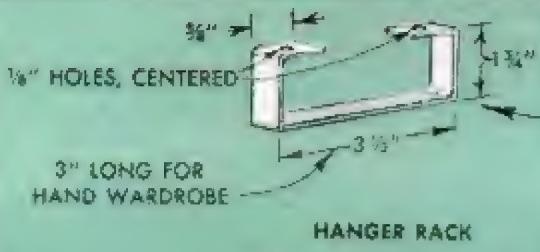


COVER FOR HINGED EDGES

9

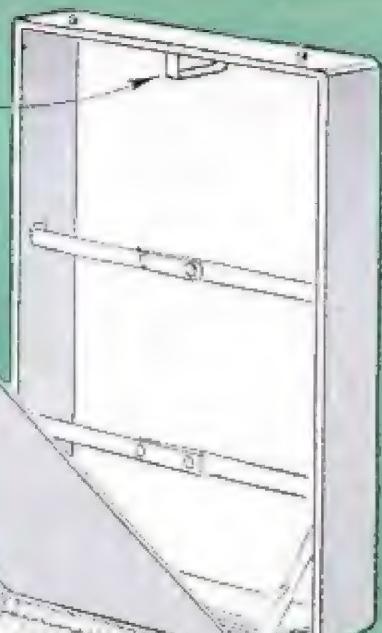


TRAIN CASE



1/8" HOLES, CENTERED
3" LONG FOR
HAND WARDROBE

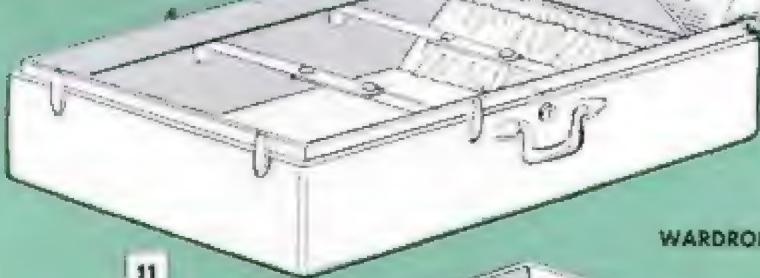
HANGER RACK



WARDROBE



VANITY CASE



11

10

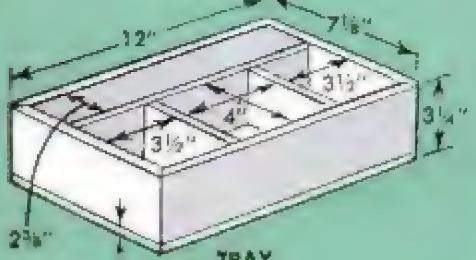
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SIDES OF CASE
LINED FIRST

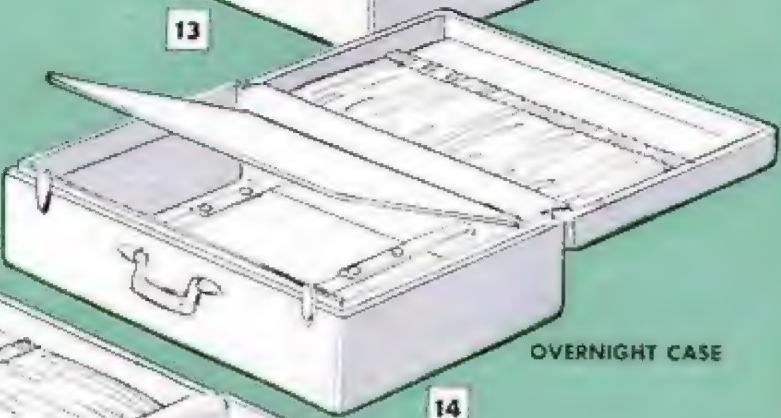
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11

11

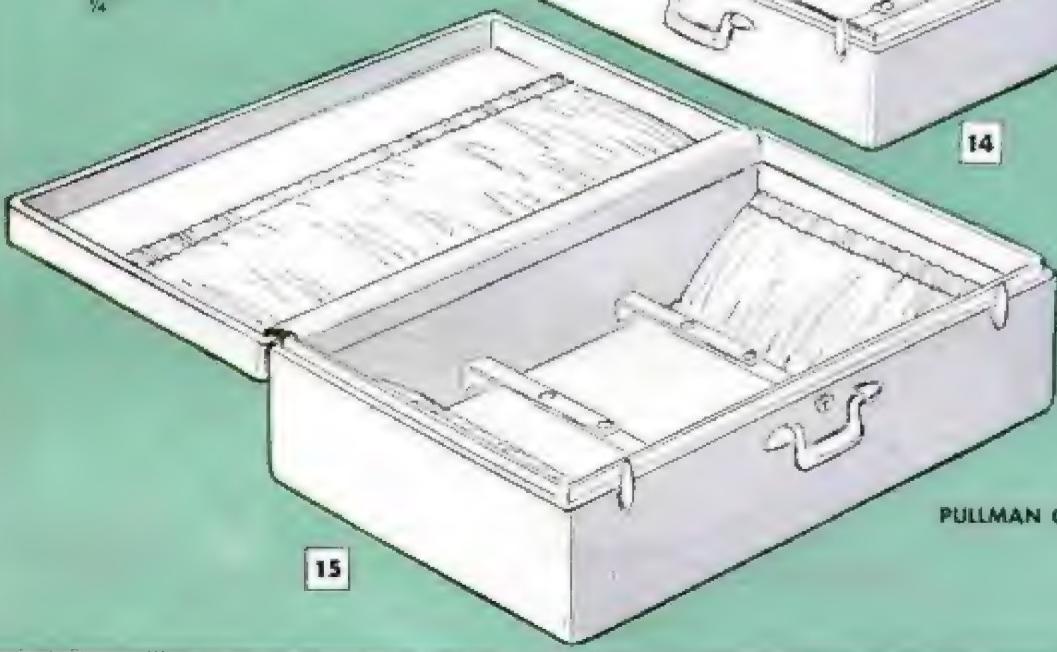


TRAY



OVERNIGHT CASE

13



PULLMAN CASE

15

a vinyl or pyroxylin-coated cloth not over 14 ga. in thickness. As this covering must be glued in place, the cloth backing is necessary for good adhesion.

If you are unable to obtain one of the glues used industrially for bonding plastic-coated cloth to wood, a satisfactory substitute can be had by using prepared liquid hide glue and glycerin. Add glycerin, 3 drops, to prepared liquid hide glue, $\frac{1}{4}$ pint. The glycerin will keep this type of glue from crystallizing and causing the cover to work loose in time.

The covering material should be just wide enough to fit snugly between the edges of the bevels and sufficiently long to extend from the bevel to the underside of the lip molding, Fig. 6. To play safe, cut the material slightly larger over all than is necessary and then trim the surplus from the edges of the bevels after the material has been glued in place. Use a steel straight-edge and a razor blade to cut the material.

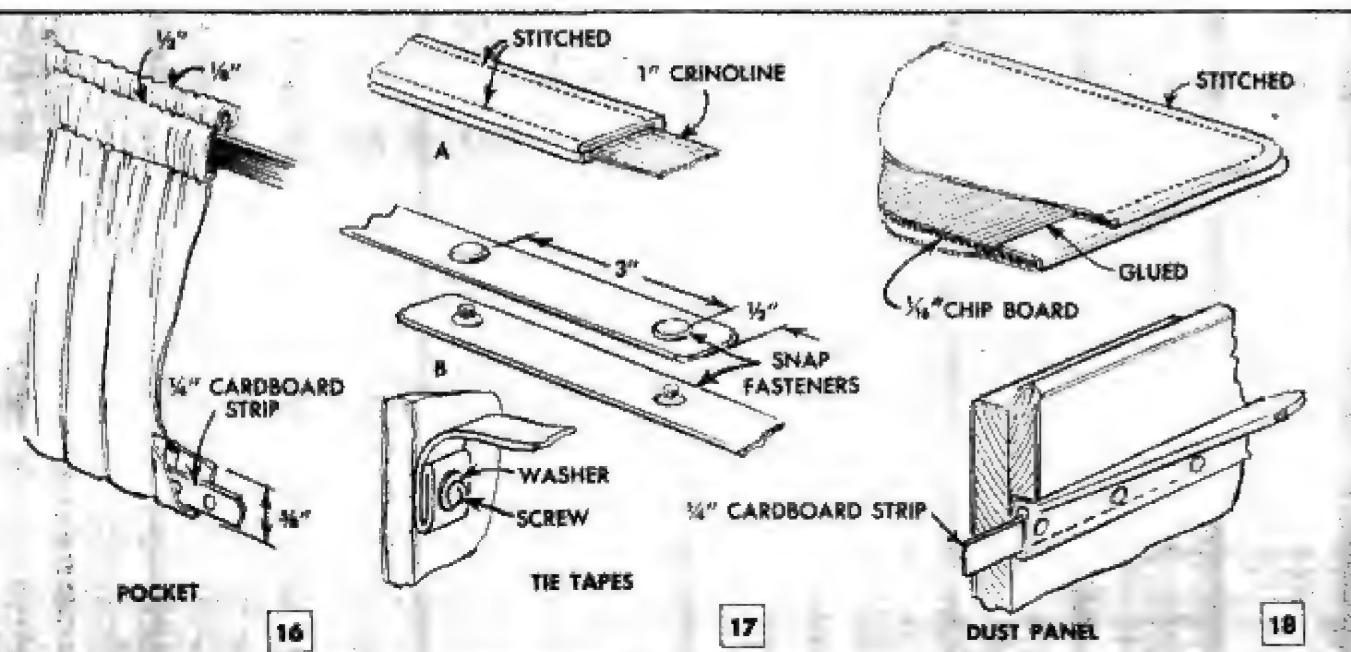
Coat the surfaces to be covered with glue, allow the glue to become tacky and then apply the plastic material. Place the edge of the material in the bottom bevel and center it between the side bevels. Working from the center, stroke the material upward and to the side, being careful that the plastic does not work away from the bottom bevel. On the lid, bring the material over the edge and down the inside. On the body of the case, bring the material to the underside of the lip molding. If the material is slightly oversize or stretches during application, trim it so it will lie smooth in the bevel and, with a wallpaper roller, press the edges down along the bevel. Remove surplus glue with a damp cloth while working and allow glue to dry for 24 hours.

All hardware is fastened to the cases with split rivets applied as in Fig. 8. Hinges and

glides are attached to the bottom of each case. A handle and a bolt-and-lock combination are added to the top of the case.

General treatment of the lining is shown in Figs. 10 to 15 and detailed in Figs. 16, 17 and 18. The lining material can be moire, satin, taffeta or any similar cloth. Before the inside of the case is lined, a cover is made for the opening between the lid and the body. Cut a 3-in. strip of crinoline and cover it on one side with lining material as in Fig. 9. With the case open, glue and tack in place, using No. 2 gimp tacks. To measure the lining material, add 1 in. to the depth of the side, and 1 in. to the total length of all four sides of the body; that is, top, bottom and endpieces, and another to cover the four sides of the lid. Apply a $\frac{1}{2}$ -in. strip of glue all around the area to be covered and, when tacky, stretch the lining in place. Be certain to work out all the wrinkles. The plywood side panels are lined next. The lining in the lid should be kept $\frac{1}{4}$ in. from the edge while the lining in the body ends under the lip molding. When cutting the lining, allow for a $\frac{1}{8}$ -in. seam on all sides of the lining. Apply glue at the corners and edges, and press the lining in place after the glue becomes tacky. Anchor the corners with No. 2 gimp tacks.

Accessories, such as pockets, tie tapes, dust panels, hanger rack, mirror and tray are installed finally. Details for these items are given in Figs. 11, 12, 16, 17 and 18. Stay arms to hold the lid open at an angle of approximately 100 deg. should be fitted to the wardrobe and vanity cases. On the wardrobe case, $\frac{1}{4}$ -in. wooden blocks covered with lining material are fastened to the sides of the lid. These blocks, which are used for mounting the stays, are located $\frac{1}{16}$ in. from the edge of the lid to clear the lip molding when the case is closed. ★ ★ ★



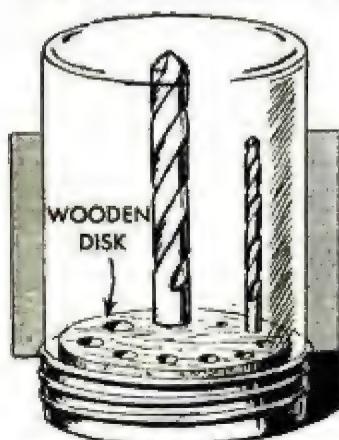


Child's Car Seat Improved By Tray and Armrests

To provide more comfort for our youngster on long automobile trips, I added wooden armrests and a small tray to her car seat, as shown. The tray bottom is plywood and the sides are thin oak strips. Linoleum covers the bottom of the tray. Two small steel angles bolted to the front cross-piece of the seat support the tray. I used two 1-in.-sq. oak pieces for armrests, running a dado lengthwise $\frac{3}{4}$ in. deep along the underside of each to take the flat-steel sides of the seat. The armrests are attached to the frame with hardwood dowels, sanded smooth and then finished with linseed oil.

Arne O. Salonen, Raymond, Wash.

Jar Provides Covered Holder For Small Twist Drills



at the side of each hole. When the inverted jar is screwed to the cap, it forms a neat, transparent cover for the drills.

Arthur Trauffer, Council Bluffs, Iowa.

Faucet Washer Used as Pilot When Starting Auger in Hole

To enlarge a hole in wood, fit a faucet washer the same size as the smaller hole over the tip of the auger used to drill the hole. The washer acts as a pilot to center the larger bit in the hole. If the washers are unobtainable, the pilots can be cut from a new piece of heavy sole leather. To do this, take an auger the size of the smaller hole and turn it in the leather until the bit has cut halfway through. Then finish cutting out the disk with a sharp knife. Unlike wooden plugs, the leather pilots will not crack or split apart and will last for years.

A. H. Waychoff, Phoenix, Ariz.



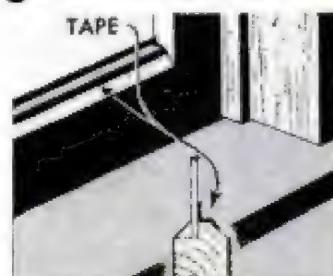
Guard Covers Handsaw Teeth



A hollow curtain rod or, better still, a length of rubber tubing that has been slit along one side may be used to guard the teeth of a handsaw when it is carried in a tool kit. If the rod is used, the seam should be spread slightly so it will slip over the saw teeth from the end of the saw. The set of the teeth keeps it from falling off.

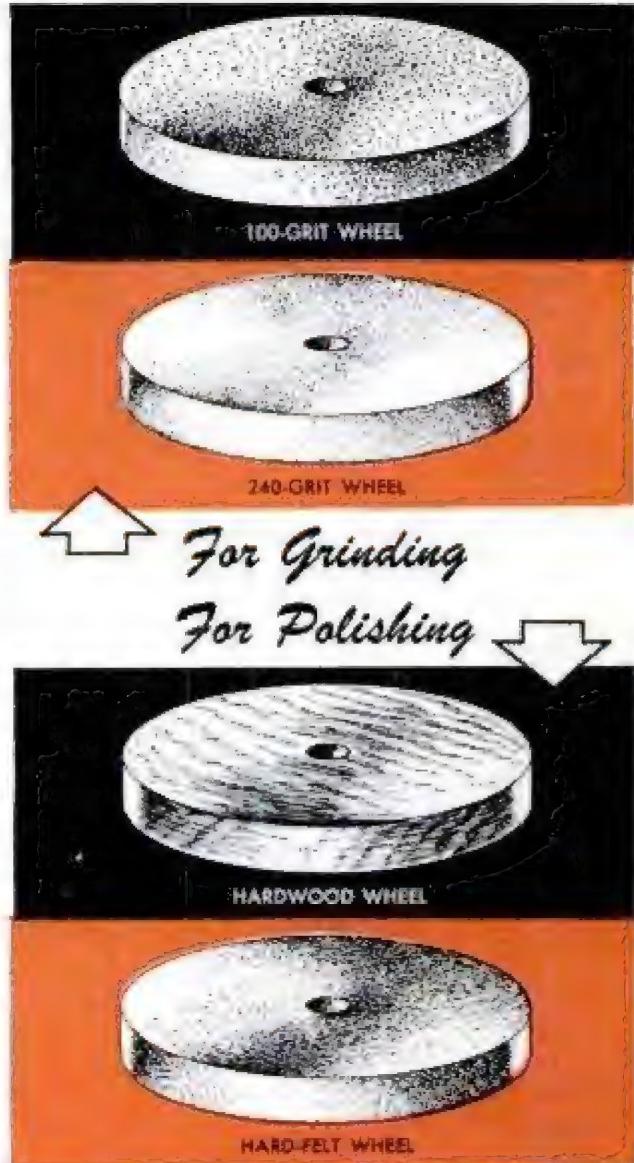
Preventing Damage to Window Sash

Damage caused to a window sash by moisture collecting between the glass and the bottom rail of the sash can be prevented by using masking tape to seal the joint. After cleaning and drying the glass, cut a strip of $\frac{3}{4}$ -in. tape slightly longer than the width of the pane and apply it as indicated. About $\frac{1}{4}$ in. of the strip should be on the glass while the remainder covers the wood. Press the ends into place so the corners of the sash are sealed tightly. If applied carefully, the tape will remain throughout the winter.



IT'S HARD TO BELIEVE that an insignificant rock or pebble picked up from the beach or the stony bed of a creek could be made into a beautiful piece of jewelry. Yet, thousands of hobbyists all over the country are doing just that—and some of them are doing it at a nice profit, too. As mentioned in Part I last month, colorful gems can be fashioned right in your home workshop from such semi-precious stone as agate, jasper, petrified wood, opal and rhodochrosite. To do this, two easily made benches are required—one for grinding the stones and the other for polishing. A diamond trim saw and a slabbing saw, plus a belt sander, are tools you may want to add at some future time; meanwhile, however, the rock slabs can be purchased ready for grinding and polishing.

The lapidary grinding bench is built around an arbor which may be one of a number of types and sizes, so the bench detailed in Figs. 1 and 2 has been designed to take most any type of arbor. When buying an arbor to suit the bench, the only requirement, therefore, is that the shaft be at least $\frac{5}{8}$ in. in diameter. If the arbor is of the low, pillow-block type, it may be blocked up with a wooden or metal mounting to elevate the wheels. The grinding wheels should be of a type designed for lapidary work, as ordinary hard-bond vitrified wheels will not cut stones. Two $1\frac{1}{2}$ x 8-in. wheels are required for this bench—one 100 grit and the other 240 grit.



From Rocks to GEMS

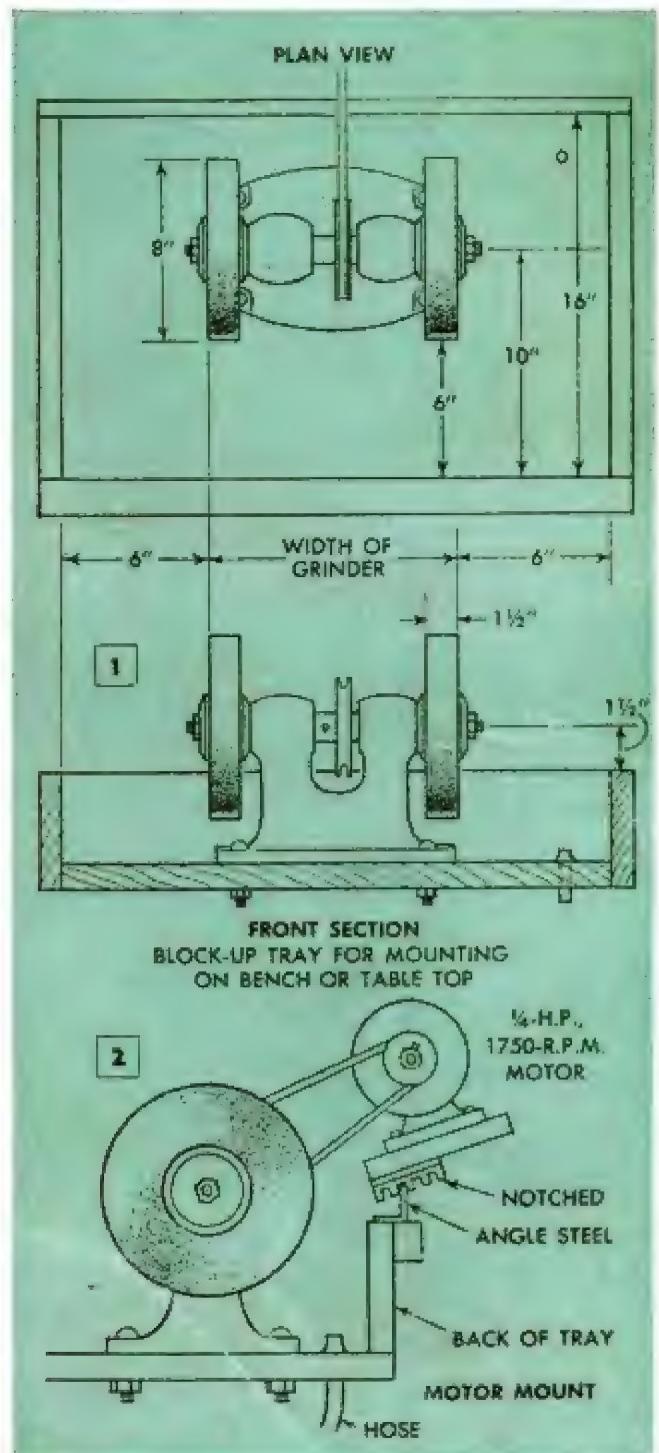
Part II

By Ray Mitchell





Preliminary polishing operation on wooden wheel is pictured above. Cloth spray apron hangs from hood



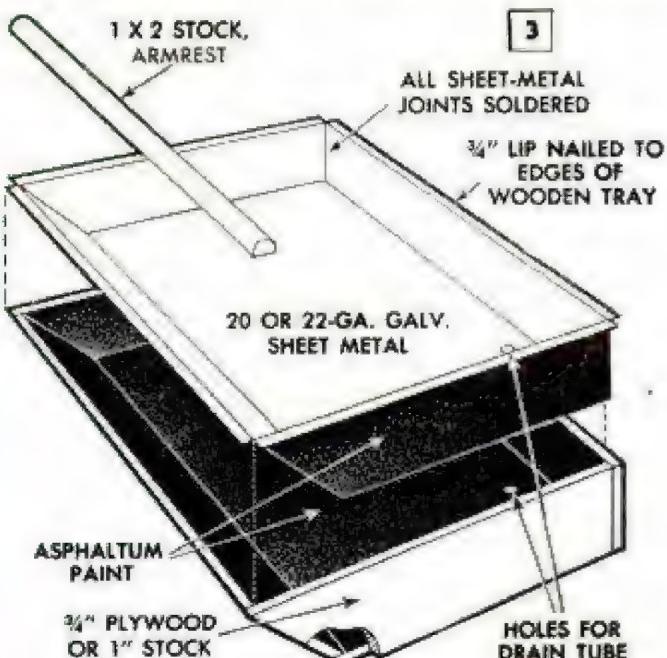
Once the arbor has been selected, the dimensions of the bench may be determined as in Fig. 1. The pan consists of a wooden tray and a sheet-metal liner, the latter being made from 20 or 22-ga. galv. sheet metal, Fig. 3. The joints are soldered carefully to prevent leaks. Then the wooden tray is built to fit around the pan, using $\frac{3}{4}$ -in. exterior-grade plywood or 1-in. lumber. The inside surfaces of the tray as well as the outside of the liner are coated with asphaltum paint, the liner is set in the tray and the $\frac{3}{4}$ -in. lip all around the liner is nailed to the edges of the tray. A wooden armrest is nailed or screwed along the front edge of the tray.

After the tray and liner have been assembled, holes are drilled through the bottom of the tray to align with the holes in the base of the arbor. Several layers of cloth or blotting paper saturated with asphaltum are placed between the arbor base and the bottom of the tray liner before bolting down the mandrel.

A drain is made from a 5-in. length of brass tubing $\frac{1}{2}$ to $\frac{3}{4}$ in. in diameter. A hole is drilled through the tray bottom near one corner and the tubing is soldered to the liner so that it projects about $\frac{1}{2}$ in. above the bottom of the pan. Thus, loose abrasive is retained in the pan while fine mud is allowed to drain off.

The motor is mounted at the rear of the tray, using a homemade motor mount or one of several free-swinging varieties on the market. Fig. 2 shows how a typical motor mount is installed. Use a 4-in. pulley on the arbor and a 3-in. pulley on the motor. Give the inside surface and bottom edges of the mandrel base a heavy coating of asphaltum paint and bolt the arbor in place.

The spray hoods are made as in Fig. 4, using 16 or 18-ga. galv. sheet metal or sheet

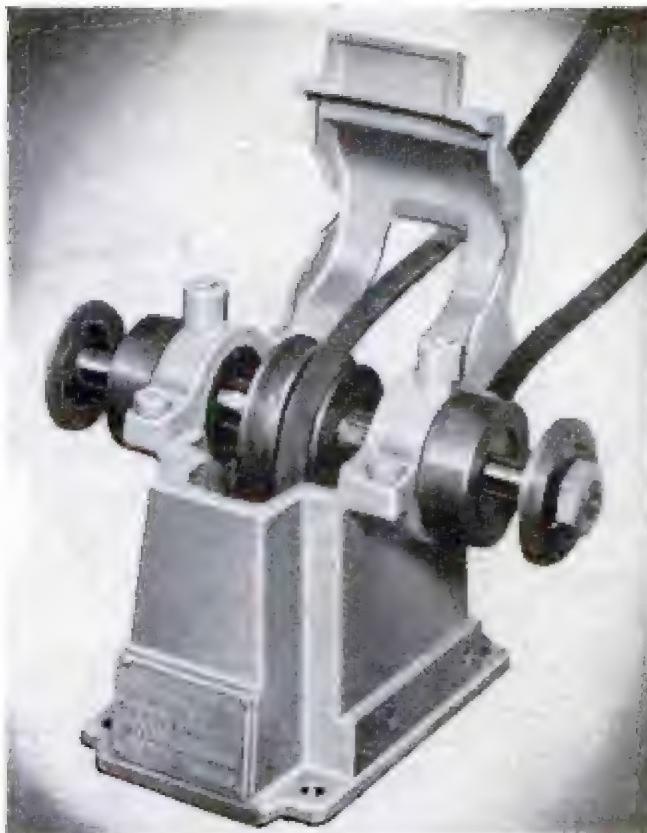


brass. A spray nozzle for each hood is made from $\frac{1}{4}$ -in. copper tubing which is bent at a right angle to enter the hood, and drilled to spray water over the face of the grinding wheel. The sharp bend is made by notching the tubing with a file, then bending and soldering the joint. As in the detail, three small holes are drilled in one side of the tubing and the end is sealed with the shank section cut from a brass wood screw which is soldered in place. The tubing is fastened to the hood with a sheet-metal clamp and wing nut, and a length of rubber hose is brought from the open end of the tubing to the faucet; preferably a mixing faucet, as cold water is likely to numb the hands when using the wheel.

The front section of the hood, which is bolted to the rear section, is slotted to allow adjustment of the spray guard as the wheel wears down. The rear section is bolted to the rear side of the tray, wing nuts being used to simplify removal of the guard. For bench top use, 4-in. wooden blocks are mounted under the corners of the tray to provide clearance for the drain tube. The tray also may be mounted permanently on its own pedestal, or used on a sink or laundry-tub drainboard.

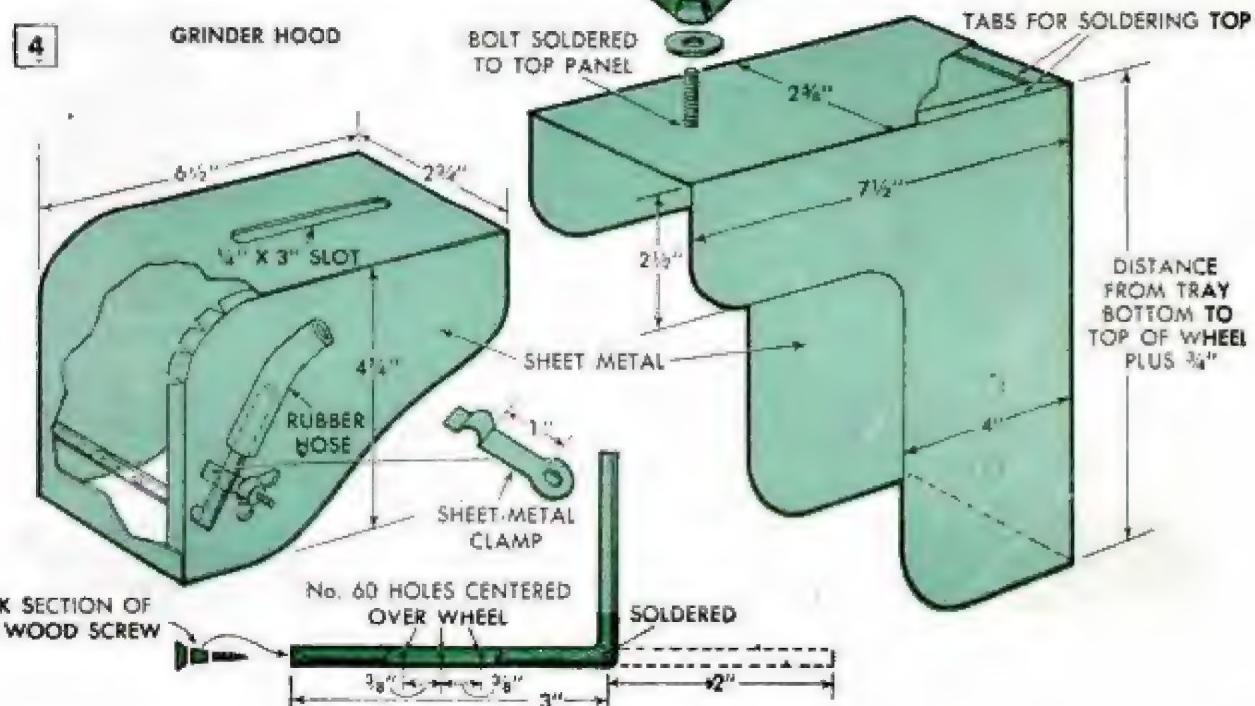
Outside of a light dressing with a diamond dresser whenever the wheel surface seems slightly bumpy or rippled, the grinding wheels require little attention. After finishing a grinding job, allow the wheel to run for a couple of minutes with the water spray turned off.

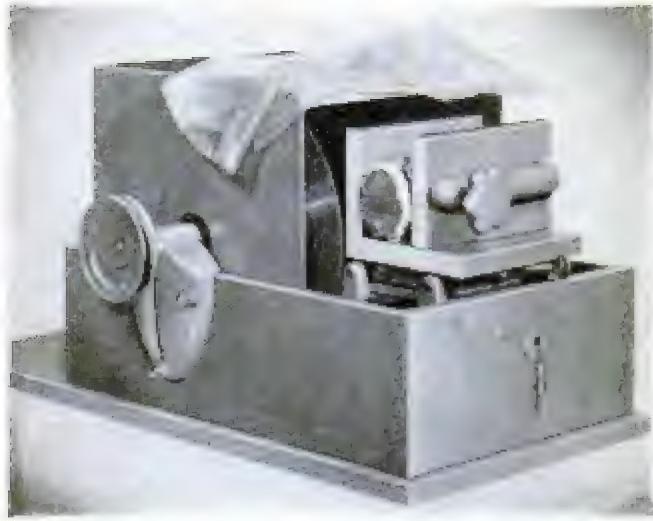
The polishing bench is built in the same way as the grinding bench, except that the spray hoods are of different design, Fig. 6. No constant stream of water is required for polishing, so the spray nozzle is unnecessary. However, a drain tube should be



Ball-bearing arbor in photo above is of a type especially suited to lapidary grinding and polishing

provided to permit washing down the pan to remove the accumulation of contaminating dust and grit. To prevent contamination of the final-polishing wheel by spray from the preliminary-polishing wheel, mount a 6 x 10-in. baffle plate at the front of the pan, Fig. 5, centering the baffle between the two wheels. Both polishing hoods should be fitted with a sheet-metal clamp to permit hanging a cloth apron from the front of the hood. The apron retains the front spray and helps distribute abrasive on the wheel. The polishing wheels



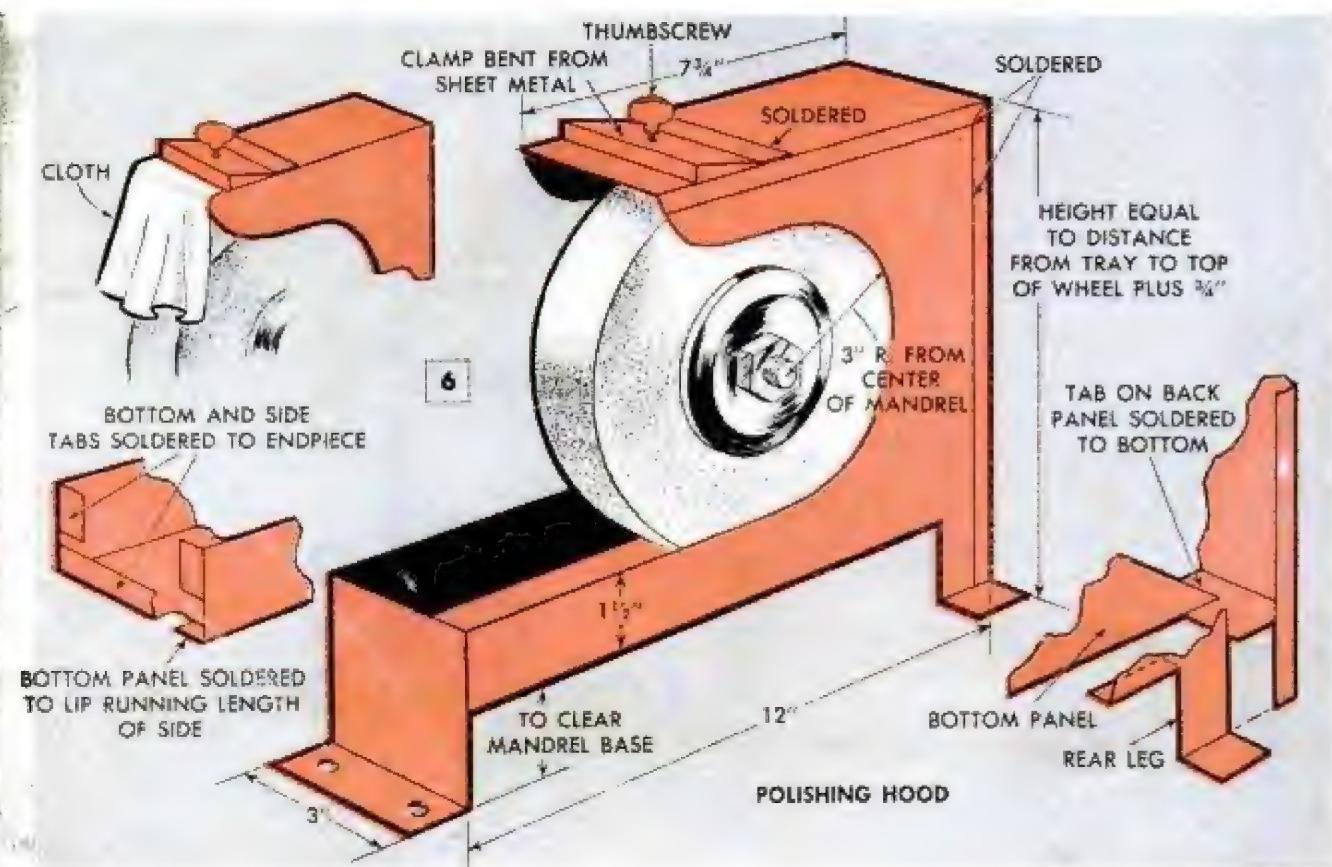
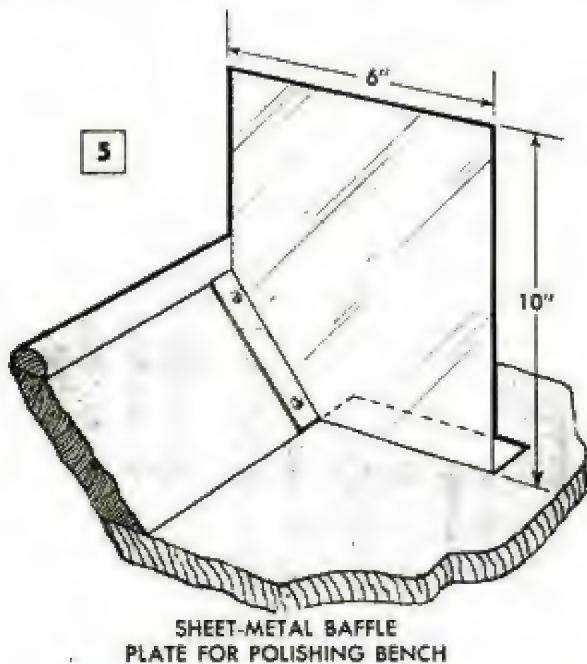


The slabbing saw, upper left, and trim saw, above, are tools you probably will want to add later. Diamond-charged blades rotate through lubricant bath

should rotate about 850 r.p.m., roughly half the motor speed.

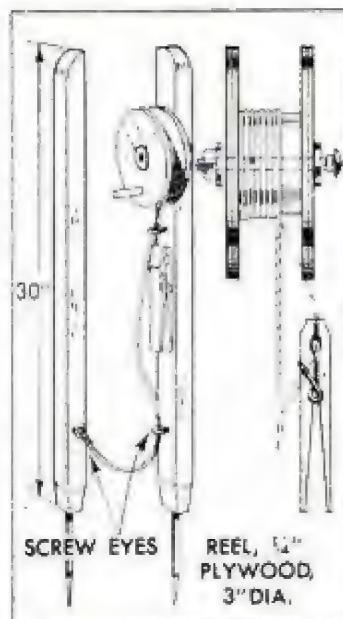
The wooden wheel for preliminary polishing may be turned from a 9-in.-sq. block of 2-in. mahogany, red gum, poplar or willow. Do not sand this wheel as the grit will contaminate the surface. The final-polishing wheel is $1\frac{1}{2} \times 8$ -in. rock-hard felt and must be purchased.

Charge the wooden wheel with tripoli powder or levigated alumina, applying the abrasive with a rag dipped in water. The felt wheel is charged for final polishing in the same way with powdered tin oxide. Make a plastic dust cover for the polishing bench and take special care to see that the felt wheel is not contaminated with abrasive used on the wooden wheel. ★ ★ ★



No-Stoop Reel Helps in Marking Garden Rows

This stake-and-reel assembly, which eliminates much stooping and kneeling when marking garden rows, is easy on your back and leg muscles. The stakes are $\frac{3}{4} \times 1\frac{1}{2} \times 30$ -in. stock and are drilled to take $\frac{1}{4}$ -in. steel rods. The sharpened ends of these rods project about 5 in. from the bottoms of the stakes. The reel consists of two 3-in. disks cut from $\frac{1}{4}$ -in. plywood and glued to a short section of 1-in. dowel, which acts as a hub. The handle of the reel is a dowel glued in a hole in the outer disk. A spring-type clothespin is mounted on the stake just below the reel. In use, a second stake is pushed into the ground, and the reel stake is carried to the other end of the



garden row, unreeling as you go. The cord is drawn tight and clamped in the clothespin after the reel stake has been pushed into the ground.—Hi Sibley, Nuevo, Calif.

Folding Cot Made Attractive With Mattress-Pad Cover

When used as extra furniture or as a spare bed in a summer cottage, an Army-type folding cot can be made attractive by covering the mattress with brightly colored terry cloth. To conceal the legs, make a duster from dyed muslin or drapery material, cutting it a width equal to the height of the cot. Next, sew the edges of the duster to the edges of an old sheet folded to the

same length and width of the cot. The sheet is laid over the top of the cot so it supports the duster which hangs over the sides. The mattress pad is now placed on the cot. If there is a shortage of material from which the duster is made, one side may be omitted. That side is placed against the wall where it will not be seen. Pillow covers can be made to match the duster.

Spinner Streamlines Outboard Propeller Hub



Small outboard motors can be given the same streamlined propeller hub that helps to lessen the drag and increase the speed of the larger, more expensive models. The cotter pin holding the propeller nut on the hub is spread so that both ends stand out from the nut. Then wood putty is applied

over this to form a smooth cone that follows the general contour of the propeller hub. In the event that a pin is sheared, the spinner may be broken off by striking sharply with a wrench.—Ed Packer, Chicago.

Attractive Finish for Floors Obtained by Spatter Method

The spatter-type finish on linoleum and wooden floors has been popular since colonial days. To apply it, first paint the floor a solid color and allow it to dry. To spatter, fill the brush with the selected color and strike it sharply against a stick held in the other hand. Make small spatters by using less paint on the brush and striking it against the stick held 1 ft. from the floor. Make large spatters by using more paint on the brush and holding the stick 3 ft. above the floor. Tack or tape a dropcloth over walls and cabinets to shield them from the spatters.

Solving

HOME PROBLEMS



1—CLOTHS for washing walls or windows won't drop from your hands when you are at the top of a ladder if you cut a double slit in the center of the cloth and insert one finger through it. This will save you many extra trips up and down the ladder.

2—BOTTLE CORKS are fine glass cleaners. Rubbed over spots on windowpanes and mirrors, they clean them almost instantly without a cleaning agent. For getting into the difficult corners of windows, the sides of the cork may be trimmed to fit the spot before using it.

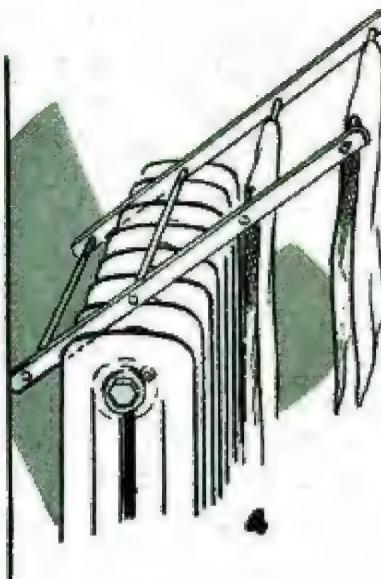
3—RAG RUGS are easier to make if this "needle" is used to weave the strips of cloth. The needle is simply a plastic-toothbrush handle pointed and then slotted so the cloth can be inserted in hole. Angle of slot prevents the cloth from slipping out.

4—THIS DRYING RACK is quickly stored and just as quickly set up. It is assembled from two strips of scrap lumber and four $\frac{3}{4}$ -in. dowels. In use, one dowel rests on radiator and lower end of rack bears against wall, so the rack is supported by its own weight.

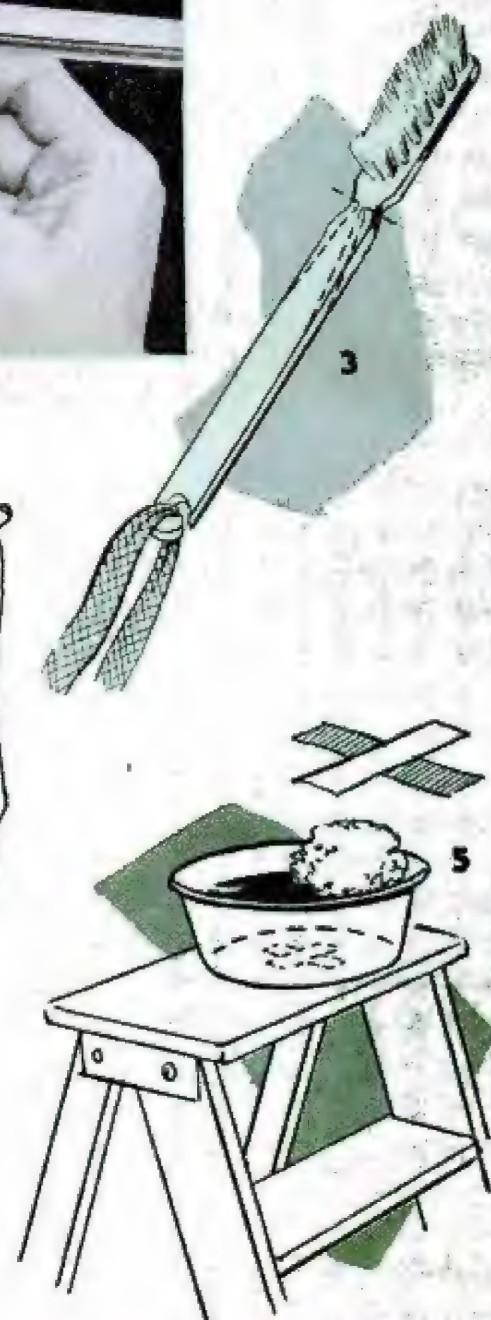
5—ADHESIVE-TAPE strips will provide a nonslip surface to prevent a basin of water from sliding off a step-ladder. The first strip is placed on ladder, adhesive side up, and second strip is laid across it, adhesive side down, to hold it in place.



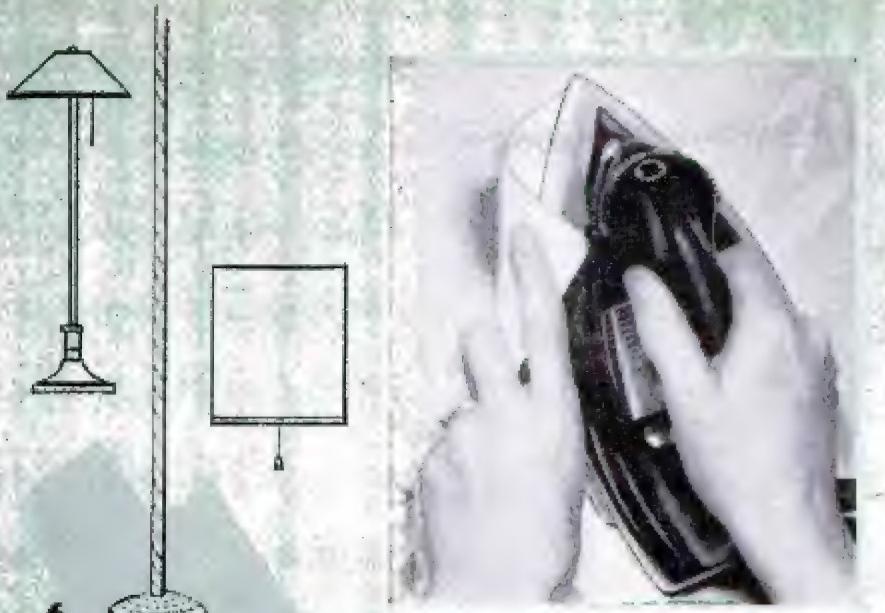
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4



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6



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8



10

6—PLASTIC THIMBLES form handy substitutes for lost or broken light-cord pendants. Make a hole in the end of the thimble either with a knife or a small drill, insert the cord through the hole and tie a large knot. Present-day colorful thimbles are also suited for replacing pendants on lamps, window shades and Venetian blinds to match room furnishings

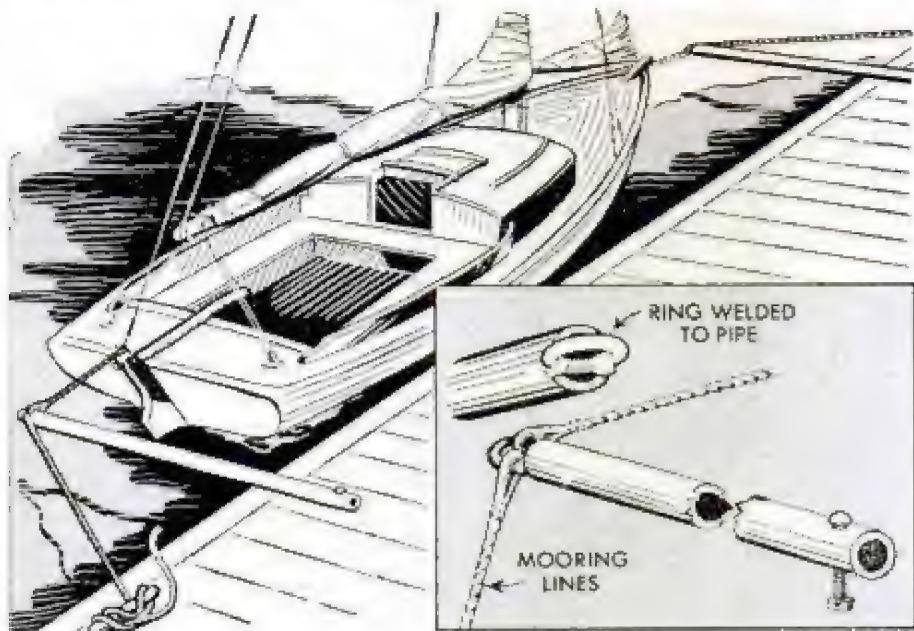
7—GREASE SPOTS on wallpaper frequently can be removed by covering them with a piece of clean blotting paper and then applying a moderately warm pressing iron. The heat liquefies the grease which is absorbed by the blotter. Use only light pressure and change blotter often as it picks up grease. Start with barely warm iron and increase heat as needed

8—PACKAGES FOR MAILING wrapped in corrugated paper are protected against damage while en route. When wrapping this material around a package, the job is simplified if the corrugated side of the paper is first scored with an ordinary clothespin. The clothespin makes a double line along which the paper can be bent without danger of tearing, breaking or uneven bending

9—YOUR FAVORITE HOUSE DRESS is easily copied by making pattern from worn-out original. First cut dress up the center, both front and back. Rip out seams of one half and starch and iron pieces flat to make stiff patterns for cutting new material. Other half of dress serves as guide when sewing new dress, showing how much to take up for seams

10—POTTED PLANTS often suffer from lack of sunlight. This won't happen with a window shelf that permits plants to be set in the sun every day. It consists of a wide board fitted with a pair of shelf brackets and hung from two screw hooks in the sash. The shelf is removable so window can be opened, and it eliminates water rings and stains on window sills

Nonchafe Mooring Prevents Damage to Boat



With this mooring gear, your boat is held away from the pier to prevent its being damaged by rough water or changing tides, and yet is close enough to hop aboard. Length of the pipe used is half the beam of the boat plus 28 in. It is bolted to the pier stringers 1 ft. from the pier edge. In waters with more than a 2-ft. tide variation it is bolted farther back. When not in use, the pipe is swung back against the mooring cleats on the pier where it is out of the way.

Defective Wiring in Heating Pad Located With Help of Radio

When our heating pad began operating intermittently, I plugged it into a wall outlet, along with our radio, in order to locate the break in the wiring without having to take the pad completely apart. Next, I turned on the radio and proceeded to flex

different parts of the pad until the radio made snapping noises. I then cut the pad open at this point, separating the insulation exactly where the break had occurred, and made the necessary repairs.

John A. Comstock, Wellsboro, Pa.

Wire Coat Hangers Bound Together Hold Trousers by Cuffs

A hanger for trousers that will help them keep their press can be made by binding two ordinary wire hangers together with wire loops. One loop is put around the necks of the two hangers to hold them together at the top. Two others, as shown in the photo, are wrapped around the hanger bars. In use, the two wire loops are pushed to the outer ends of the bar and the trouser cuffs are brought up between the hangers. Then the wire loops are pushed toward the center, tightening the grip of the hanger bars on the trousers.

Ken Murray, Colon, Mich.



Glue Spreader for Modelmakers From Small Flat Spring



Modelmakers and hobbyists who have occasion to spread glue or cement in small quantities, such as along the edges of narrow strips, will find this spreader applicator handy. It is made by inserting a short length of flat alarm-clock spring, $\frac{1}{8}$ in. wide, in a wooden penholder. The tip of the spring is bent slightly with a pliers.

John J. Rea, Urbana, Ill.

India-ink stains can be removed from nylon if the stain is first rubbed with lard and then washed in a detergent.



"Flagstone" Walk Poured Without Forms

All the work of making forms when pouring a simulated flagstone walk was avoided by one homeowner who merely dug holes in the ground and poured the concrete into them. The holes should be at least 4 in. deep and shaped to resemble flagstones. Be sure to keep the sides of each hole true vertically so that the stones will be of uniform thickness. If desired, the upper surface of each stone can be made to resemble the surface of a true flagstone by roughing it. To do this, lay heavy Manila paper over it and then press in the shape of the surface with your hand. A little ex-

perimenting will enable you to do a good job of simulating flagstones. Let the newly poured concrete set slightly before doing this, however, so that the surface will hold the shape impressed into it. For the concrete, use a mixture of portland cement, 1 part, and sand, 3 parts, adding enough water to obtain a working consistency. Fill each hole level with the ground and strike off the top of the concrete with a wooden float. Then trowel smooth and, as soon as the concrete begins to set, bevel the top corners slightly all around.

Dick Hutchinson, San Gabriel, Calif.

Convert Baby's Car Seat to Double as Portable Swing

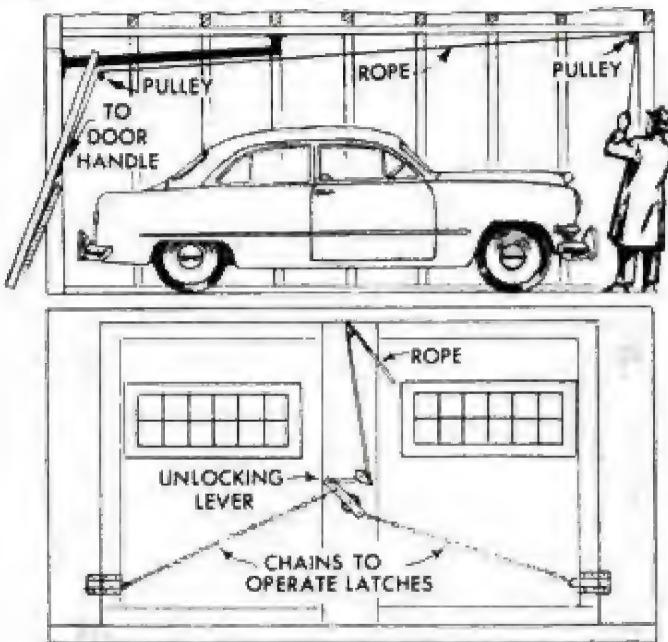
A baby's car seat can double as a portable swing with only a few minor alterations. Four screw eyes turned into wooden arm-rails provide suspension points for the swing. If the swing is to be used regularly in the yard, four ropes are prepared by attaching swivel snaps at each end. The snaps clamp into the screw eyes on the chair and to a harness or ring on a tree limb or other support. The front ropes should be slightly shorter to provide a comfortable tilt. If the swing is to be portable, to take along on trips, prepare two double length ropes with swivel snaps at each end. These ropes may then be thrown over any convenient support to set up the swing. The screw eyes in the armrails of the chair do not interfere with its regular use as a car seat.

E. V. Reyner, Townsend, Mont.

¶A razor blade laid flat on drawing paper or a typewritten sheet will provide a very satisfactory erasing shield.

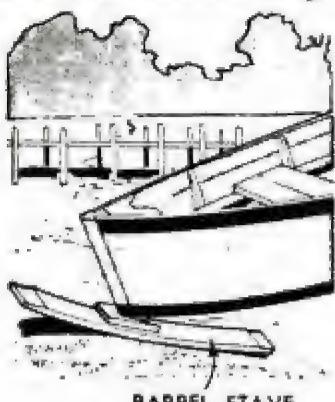


Overhead Garage Door Opened By Pulley Arrangement



As an additional convenience for auto owners, overhead garage doors can be altered to be opened from the opposite end of the garage as well as at the door itself by means of the pulley arrangement illustrated in the detail. A small rope through the pulleys is attached to the latching lever of the door, so that the first tug on the rope releases the latch, and further pulling opens the door. A small weight is tied to the rope to serve as a handle and to take up any slack.—Hugh Lineback, Stillwater, Okla.

Barrel-Stave Runner Under Bow Aids in Beaching Rowboat



stave as shown. The runner is slipped under the stem of the boat and then lifted while the boat is pushed forward.

G. E. Hendrickson, Argyle, Wis.

Precaution for Home Emergency

In most instances, a few minutes' indecision when attempting to recall the location of the water shutoff valve or main electrical switch during an emergency in a home, will result in needless damage. To

assure locating the right valve or switch as quickly as possible during the excitement of the emergency, one homeowner painted directional arrows on the floors and walls from the basement steps. Arrows of different colors were used for each unit.

Weed Cutter Made From Blade Of Discarded Butcher Knife

An efficient weed cutter can be made by removing the handle of a butcher knife and riveting the blade in the slotted end of a broomstick. After riveting, the blade is bent to the desired working angle. In use, the cutter is swung like a golf club, and if kept sharp, will cut even the most stubborn weeds.



Outboard Transom on Small Boat Protected With Rubber Tread



In order to prevent the transom on a small motorboat from becoming marred by repeated fastening and unfastening of the transom clamps of an outboard motor, cover the area directly beneath the motor with a piece of rubber tread such as the kind used on stair steps. Cut the tread to the size needed and use waterproof glue to hold it in place.—John Krill, North Lima, Ohio.

Since ordinary wax paper is neither moisture nor vapor proof, it is not desirable for use as a wrapping material for food to be frozen.

Four PLANTERS

By Bob Kuntz, Jr.

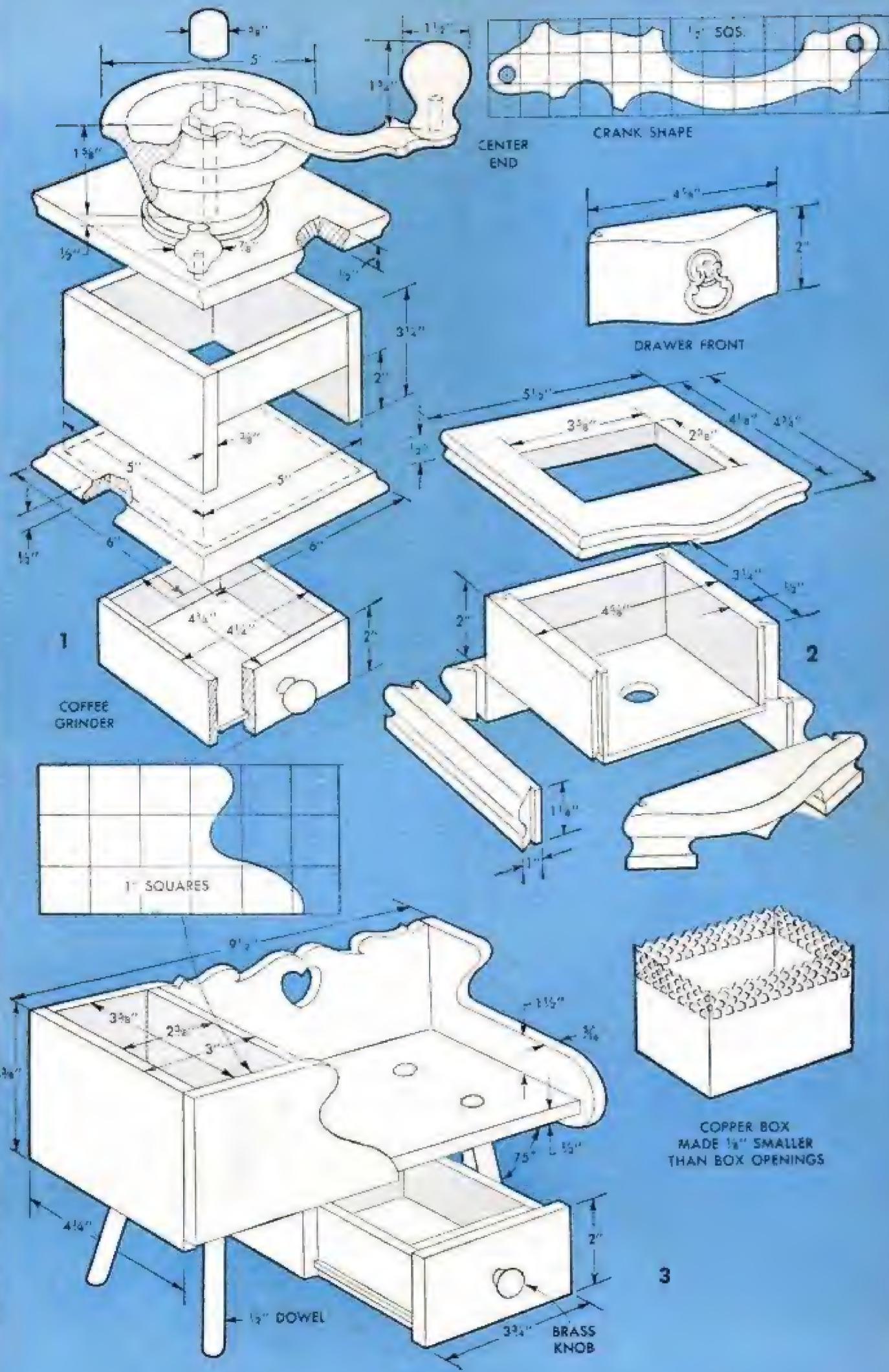


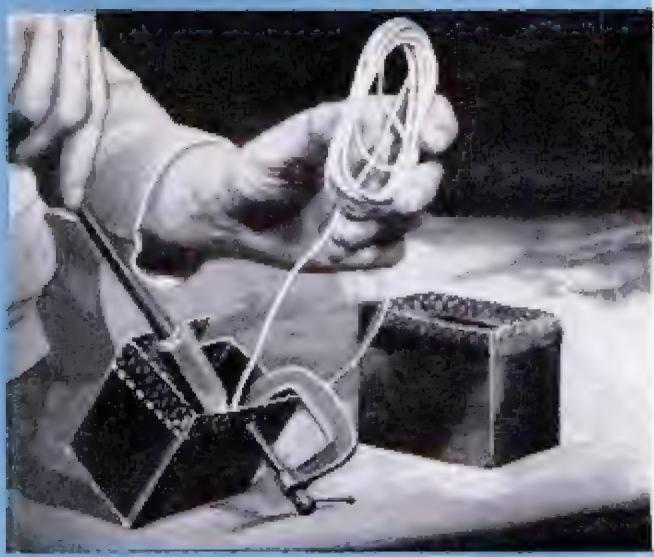
ANY ONE OF THESE four little planters will appeal to the craftsman who enjoys making one-evening projects that require but a minimum of time and material. With the possible exception of planter No. 1, which involves turning, you can complete any of the planters in a few hours' time, especially if your shop is equipped with a small shaper or a drill press fitted with a shaper attachment. Items such as these also lend themselves to spare-time profit as the parts are such that they can be quickly mass-produced with home-workshop power tools. Simple fixtures may be improvised to hold the work for duplicate cutting. Scraps of choice cabinet woods left over from other jobs are ideal for these little planters and keep the cost at a minimum. Carefully made and finished, they'll bring a handsome profit to the enterprising craftsman.

Where facilities are lacking for shaping a molded edge by machine, the various shapes shown can be modified by forming a plain rounded edge with a file and sandpaper. In some cases a small stock molding may be tacked on separately. The assembly of each planter is clearly shown in the accompanying drawings. You'll note that planters Nos. 2 and 4 have dummy drawers which are fitted with a decorative metal stamping. The latter is merely soldered to the upper edge of each liner so that it projects above the top of the planter. Note that each of these two particular planters has a hole in the bottom panel to permit the liner to be pushed upward with the finger for easy removal. The drawer handle on planter No. 4 is a brass label pull.

In the case of the coffee-grinder planter, the drawer serves as a pot for the plant. Here the

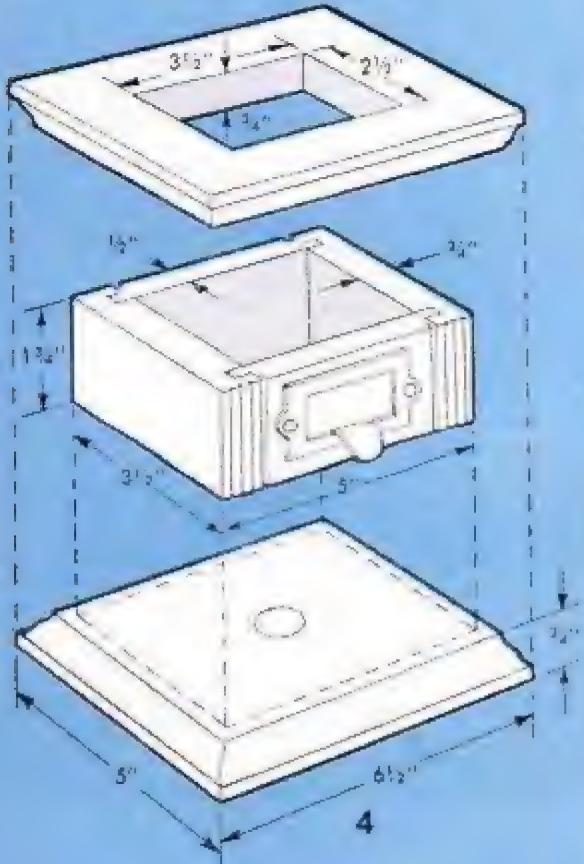






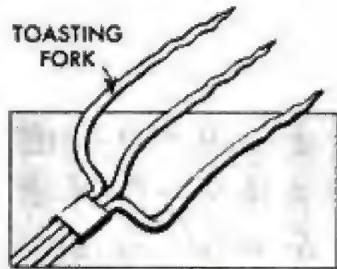
Decorative brass stamping may be soldered around edges of copper liners used for planters Nos. 2 and 4. Then the brass is polished and lacquered

liner for the drawer is made with a slight lip to overhang the edges of the drawer. The drawer under the cobbler's bench, planter No. 3, is made as a usable drawer while a separate compartment holds the plant. The bowl-shaped turning for the coffee-grinder planter is made from a 5-in. block of wood, $1\frac{1}{8}$ in. thick, following the shape indicated, after which it is fitted with a scroll-cut handle. This can be glued in a fixed position on the dowel center pin or left free to rotate. Use a good waterproof resin glue to fasten the various parts together, adding small brads for additional strength. ★★★



Nonslip Tines on Roasting Fork

To prevent both marshmallows and hot dogs from slipping off a toasting fork when being roasted over an open fire, bend ripples in the tines of the fork. This can be done with a pliers or by placing the fork on a block and denting the tines with a hammer.—R. M. Woodbury, Natick, Mass.



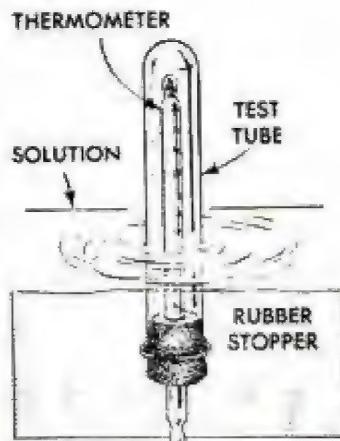
Discarded Pressing Iron Serves as Anvil

A small anvil for a home workshop may be improvised quite easily from an old pressing iron that has been turned upside down and mounted on a sheet-metal base. After drilling two holes near the center of the base to correspond with those in which the handle formerly was bolted, drill a hole in each of the four corners. The two centered holes take bolts for attaching the base to the iron, while the four corner holes are provided for bolting the iron to a work-bench or to a block of wood.

C. W. Kirkpatrick, Bakersfield, Calif.

Floating Thermometer Checks Temperature of Liquids

Inserted in a test tube that has been tightly stoppered, a thermometer for checking the temperatures of liquids will float and be easy to read. The thermometer is fitted snugly into a hole in the rubber stopper, with the bulb projecting from the stopper, which then is inserted in the test tube. Such a thermometer is especially handy when used with gun-bluing solutions and photographic-film developers.



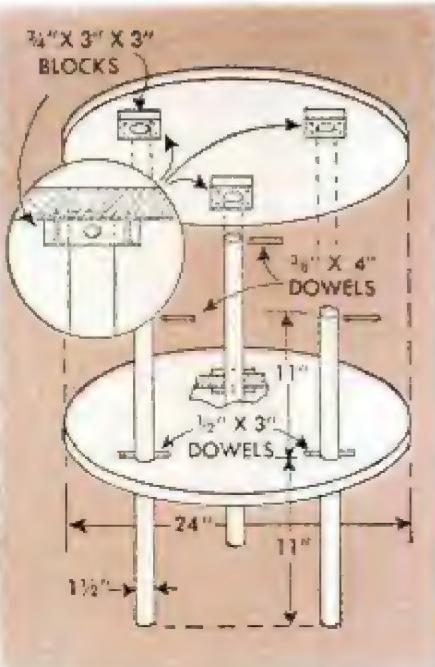
Joseph J. Rosenski, Chicago.

Salvaging Worn Wringer Rollers

Worn rollers on a washing machine often can be made to grip clothing efficiently once again by scoring grooves lengthwise, $\frac{1}{4}$ in. apart, around each roller. The grooves, which should be about $\frac{1}{32}$ in. deep, are cut on a circular saw.

I. S. Ipe, Youngstown, Ohio.

Knockdown Table Assembled With Dowel Pegs



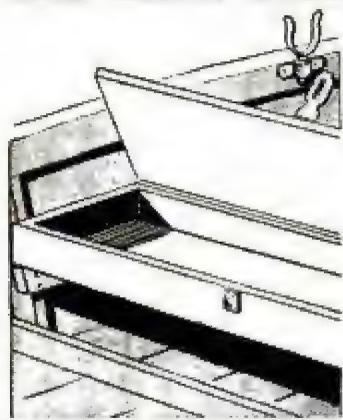
You don't have to be an expert craftsman to construct this versatile utility table which will find popular use in almost any room of a house, as well as in a garden or back yard. Assembled with dowel pegs, the table may be dismantled or set up in a jiffy

simply by removing or replacing the pegs. Both the circular top and shelf are cut from $\frac{3}{4}$ -in. plywood, with exterior-grade plywood used if the table is to be exposed to the weather. Shallow blind holes are bored in the underside of the top for $1\frac{1}{2}$ -in. drapery-pole legs which pass through holes drilled in the shelf in corresponding locations. Wooden blocks, bored to slip over upper ends of the legs, are cross-drilled for the dowel pegs, centered over the blind holes and attached with screws. Holes, $\frac{1}{8}$ in. apart, are drilled through each

leg for the insertion of $\frac{3}{8}$ -in. dowels which, when placed above and below it, hold the shelf in place. Before the table is assembled, all pieces are sanded thoroughly and finished in the color desired.

I. M. Fenn, Chicago.

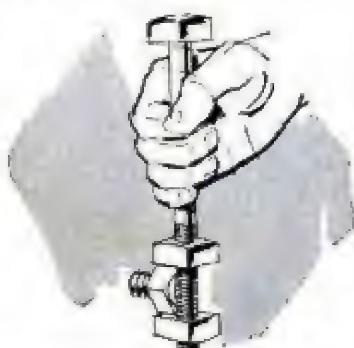
Gear Locker Under Rowboat Seat



Many essential items for fishermen or hunters may be carried safe and dry in a locker built under the seat of the rowboat. The seat is removed and the locker is built of the same length and width in its place. The seat is

then hinged in place as the locker cover. A hasp and staple should be provided so that the locker can be padlocked when the boat is left unattended.

Emergency Wrench Improvised From Two Nuts and a Bolt



When no adjustable wrench is at hand, one can be improvised by threading two square nuts on a long bolt. The nuts must tightly fit the nut they are to turn before leverage is applied.



Graphite on Boat-Trailer Tires Prevents Sticking to Rims

Wheel flanges and beads on boat-trailer tires have a tendency, after numerous immersions in salt water or water having a high mineral content, to stick to the rims. This may be prevented by making a paste from flaked or powdered graphite mixed with water and applying it to the beads and flanges as indicated.

Clinton R. Hull, Costa Mesa, Calif.

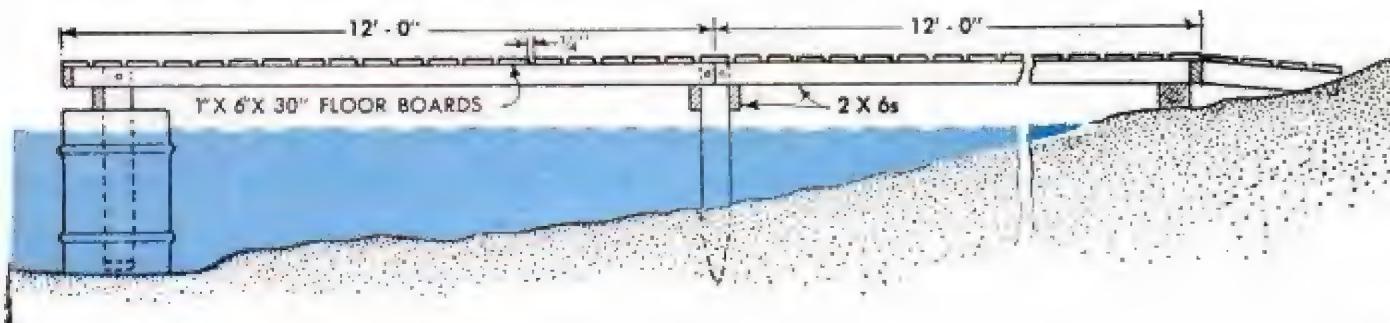
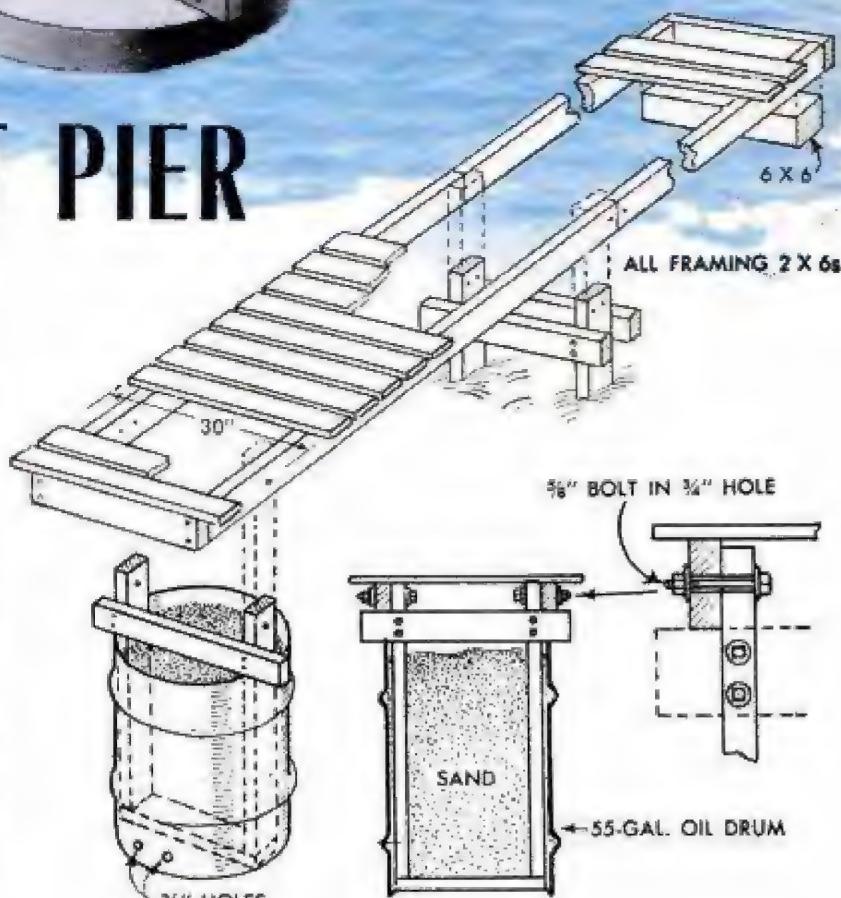
To clean a brick fireplace, scrub the bricks with hot water containing trisodium phosphate, 2 tablespoonfuls, and then rinse with clear water. Be sure to wear rubber gloves to protect the hands.



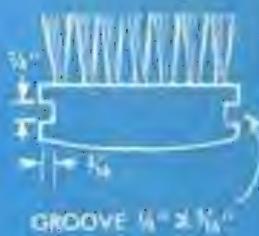
TAKE-APART PIER

By Hi Sibley

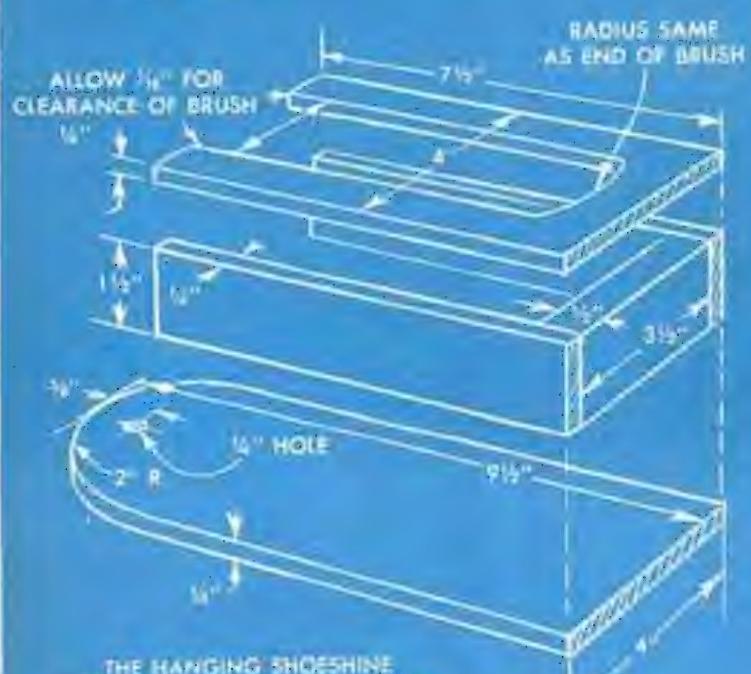
HERE IS A SIMPLE, inexpensive boat pier designed for inland waterways that can be dismantled easily for winter storage. The outer support is a common oil drum with one head cut out and inlet holes drilled along the bottom. A frame of 2 x 6s is set inside the drum, and the drum is filled with sand. An intermediate support for the catwalk consists of 2 x 6 crosspieces fastened to two stakes driven into the river bed. Joists are bolted to the supports as shown and the catwalk is floored with 1 x 6 boards. To dismantle, remove bolts and float catwalk sections ashore.



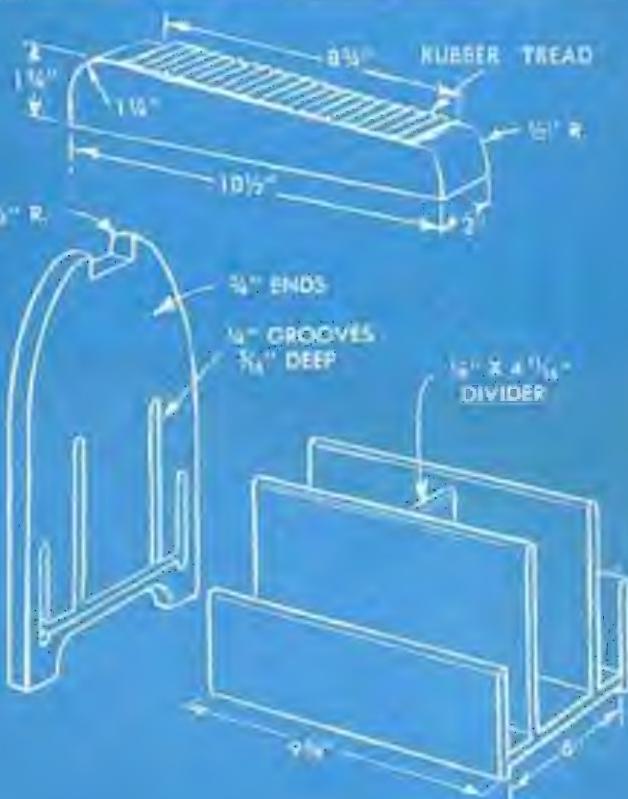
PLAN of the MONTH...



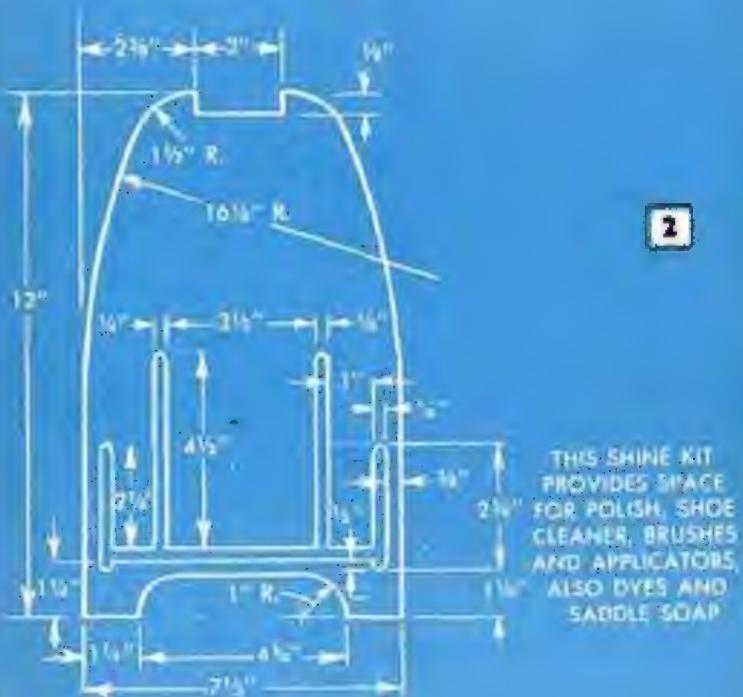
1



**THE HANGING SHOESHINE
KIT CAN CONTAIN BRUSH, ONE
CAN OF POLISH, POLISH APPLICATOR
AND A POLISHING CLOTH**



1



Shoeshine Boxes

Material List

All stock can be either lumber or plywood

Box No. 1

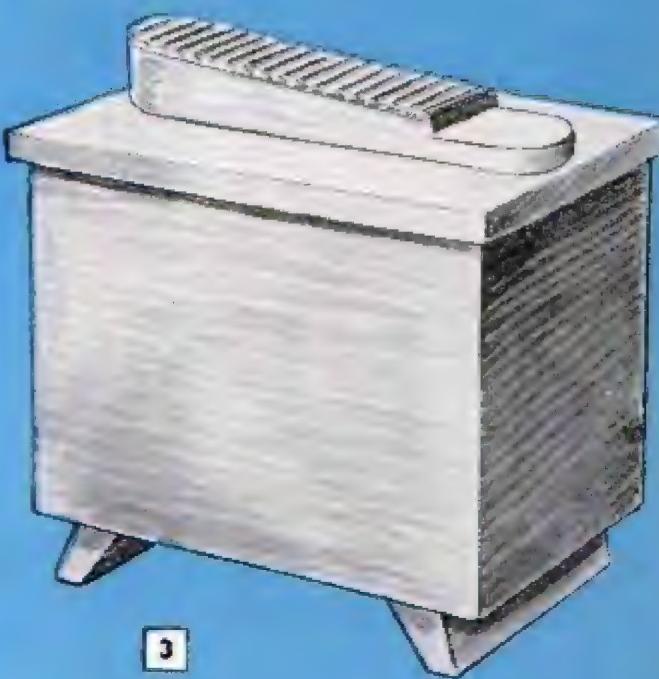
1-Brush
 1- $\frac{1}{2}'' \times 1\frac{1}{2}'' \times 3\frac{1}{2}''$ -Bottom
 1- $\frac{1}{4}'' \times 4'' \times 7\frac{1}{2}''$ -Face
 1- $\frac{1}{4}'' \times 4'' \times 9\frac{1}{2}''$ -Back
 2- $\frac{1}{4}'' \times 1\frac{1}{2}'' \times 7\frac{1}{2}''$ -Sides

Box No. 2

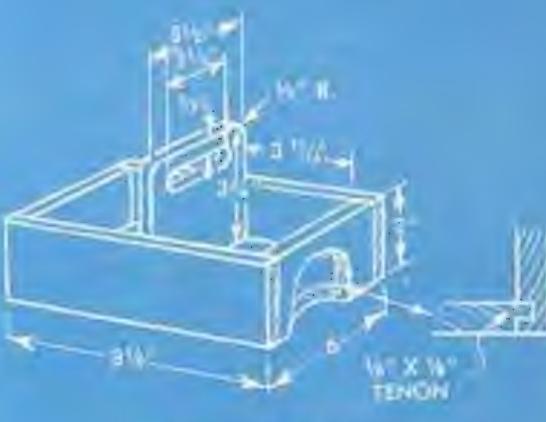
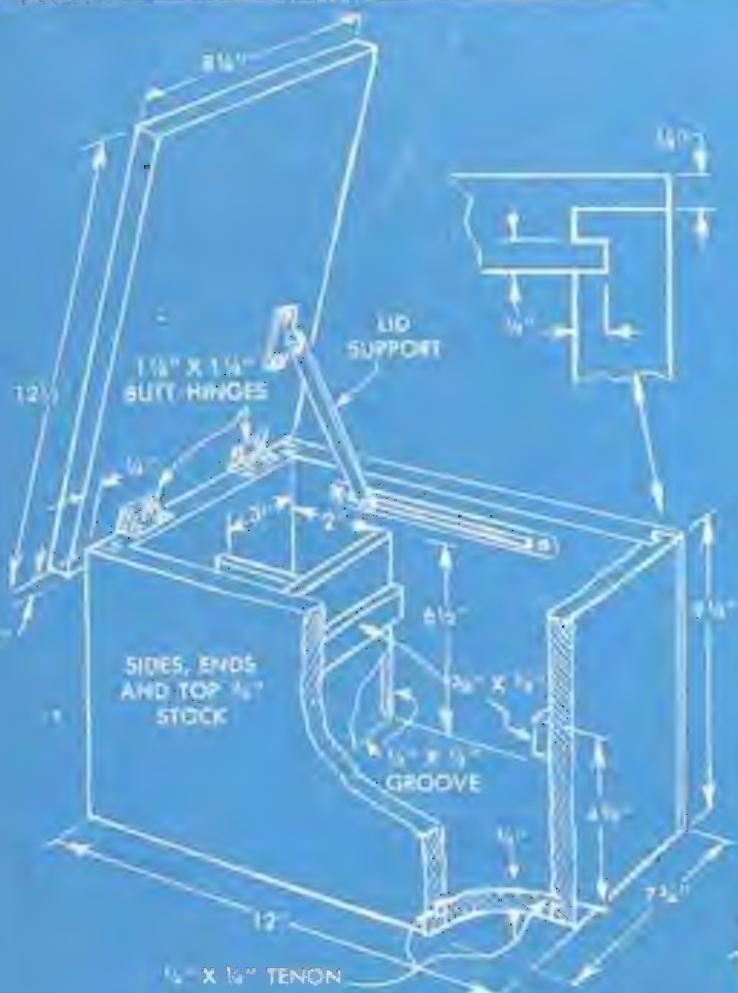
2- $\frac{3}{4}'' \times 7\frac{1}{4}'' \times 12''$ -Ends
 2- $\frac{1}{4}'' \times 2\frac{5}{8}'' \times 9\frac{3}{8}''$ -Sides
 2- $\frac{1}{4}'' \times 4\frac{1}{2}'' \times 9\frac{3}{8}''$ -Partitions
 1- $\frac{1}{4}'' \times 3\frac{1}{2}'' \times 4\frac{1}{4}''$ -Partition
 1- $\frac{1}{4}'' \times 6'' \times 9\frac{3}{8}''$ -Bottom
 1- $1\frac{3}{4}'' \times 2'' \times 10\frac{1}{2}''$ -Footrest
 1- $2'' \times 8\frac{3}{4}''$ -Rubber tread

Box No. 3

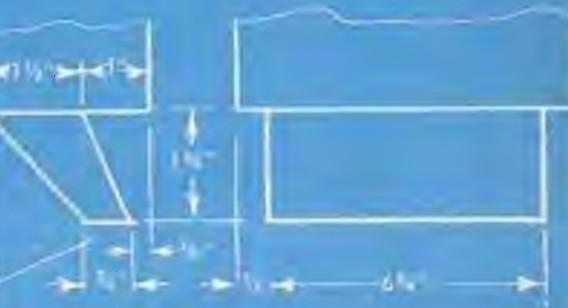
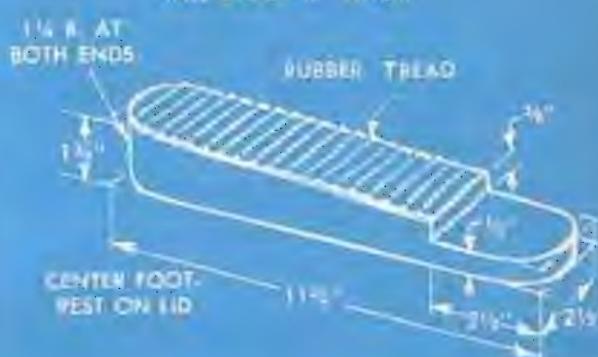
1- $\frac{3}{4}'' \times 8\frac{1}{4}'' \times 12\frac{1}{2}''$ -Lid
 2- $\frac{3}{4}'' \times 9\frac{1}{4}'' \times 12''$ -Sides
 2- $\frac{3}{4}'' \times 7\frac{1}{4}'' \times 9\frac{1}{4}''$ -Ends
 1- $\frac{3}{4}'' \times 7\frac{1}{4}'' \times 11''$ -Bottom
 2- $1\frac{1}{2}'' \times 2\frac{1}{2}'' \times 6\frac{3}{4}''$ -Feet
 1- $1\frac{3}{4}'' \times 2\frac{1}{2}'' \times 11\frac{3}{4}''$ -Footrest
 1- $\frac{1}{4}'' \times 2\frac{1}{4}'' \times 6\frac{3}{4}''$ -Partition
 1- $\frac{1}{4}'' \times 6\frac{3}{4}'' \times 6\frac{3}{4}''$ -Partition
 2- $\frac{3}{8}'' \times \frac{3}{4}'' \times 6\frac{1}{4}''$ -Cleats
 2- $\frac{1}{4}'' \times 2'' \times 8\frac{1}{8}''$ -Tray ends
 2- $\frac{1}{4}'' \times 2'' \times 5\frac{1}{2}''$ -Tray sides
 1- $\frac{1}{4}'' \times 3\frac{3}{4}'' \times 5\frac{1}{2}''$ -Tray partition
 1- $\frac{1}{4}'' \times 3\frac{3}{4}'' \times 5\frac{3}{4}''$ -Tray bottom
 2- $1\frac{1}{4}'' \times 1\frac{1}{4}''$ -Butt hinges
 1- $5''$ -Lid support
 1- $2\frac{1}{2}'' \times 9\frac{3}{8}''$ -Rubber tread



3



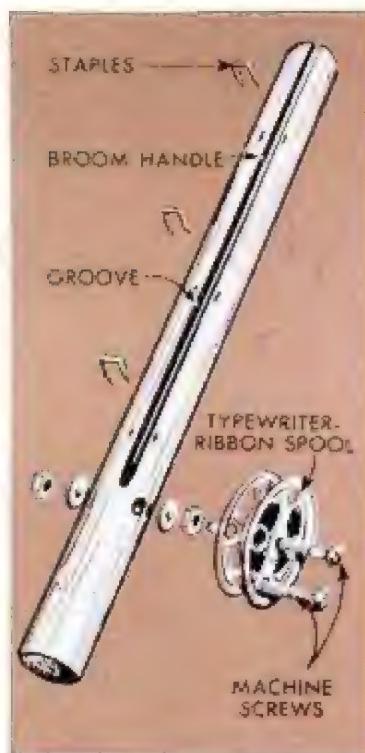
REMOVABLE TRAY
(ALL STOCK $\frac{1}{4}$ " THICK)



FOOT DETAIL

THIS BOX DESIGNED TO
CONTAIN SAME MATERIALS
AS LOWER KIT ON
OPPOSITE PAGE

Youngster's "Rod and Reel" Replaces Drop Line



The young fisherman who finds that his drop line is sometimes hard to handle and gets away from him, will enjoy using the "rod and reel" shown in the diagram. The rod is a length of broomstick with a groove cut in it to guide the line. Staples driven across the groove hold the line in it. The reel is constructed from a typewriter-ribbon spool and machine screws, and is bolted to the rod. With this rig, there will be no more lines lost in the water or fouled as they are pulled in without a reel.—George J. Berkwitt, New York City.

Floor Furnace Protected From Floods by Tar-Coated Tub

In areas easily flooded by heavy rains, floor furnaces in basementless houses can be protected from floodwater by the installation of a tar-coated washtub around the furnace. Strap-steel brackets, long enough to reach the joists under the house, are slotted near the top and riveted or

bolted to the tub. The tub is then located under the furnace and bolts or lag screws passed through the slots in the strap steel and into the joists. Thus, as the water rises, the tub will rise with it, protecting the furnace from flood damage and rust.

Ralph A. Ellis, Norfolk, Va.

Duplicate Tapered Pegs Formed in Jig on Disk Sander

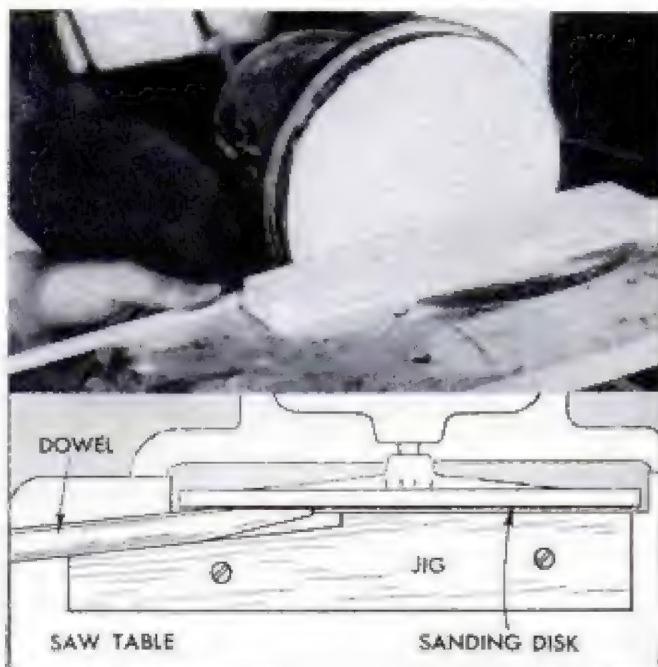
Here is a method for forming both round and square tapered pegs on a disk sander that quickly produces any number of pegs of identical size and shape. The jig is made from a $\frac{3}{4}$ -in. board, cut as shown in the drawing, and is attached to the worktable with screws. To use, start the machine and feed the dowel in, turning it slowly until it reaches the stop. This will result in an evenly tapered peg. Cut it from the dowel and repeat. Square pegs are made in the same manner, except that the material is fed straight in without turning.

Dick Hutchinson, San Gabriel, Calif.

Atomizer Used as Plant Sprayer

When potted plants and flower boxes require spraying with an insecticide, an old perfume or throat atomizer will be found ideal for the job. Because the atomizer spray is easy to control and has only a short range, the insecticide will be directed only at the plants and not at near-by furniture and window sills.

Mrs. Julia Martin, Springfield, Mass.



Mildewed wall surfaces should be washed thoroughly with a solution of paint cleaner in warm water before a new coat of paint is applied.

Weatherproof CAR-TOP CARRIER

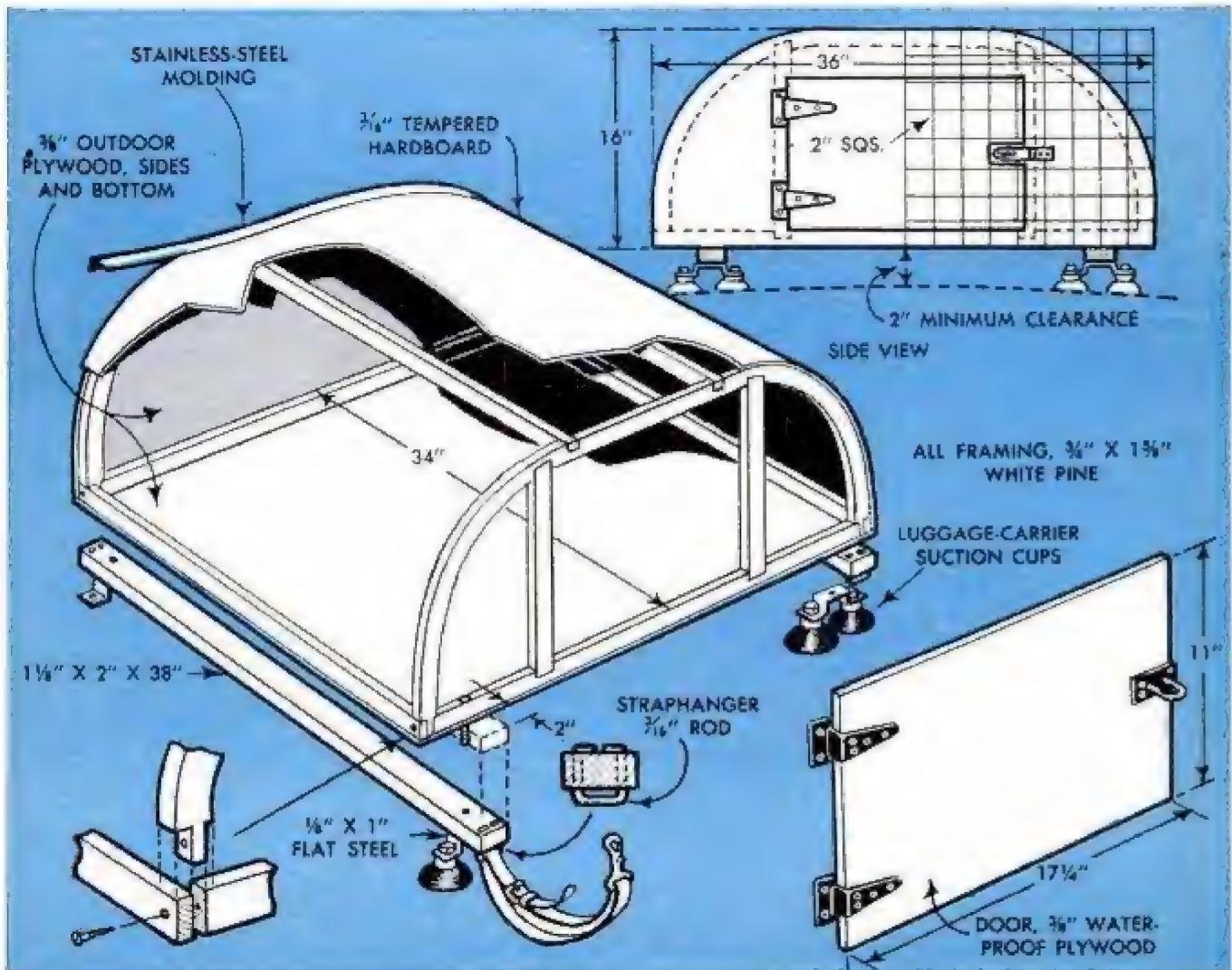
By Hi Sibley



LIMITED TRUNK SPACE need not cramp your motoring comfort this vacation. A weatherproof storage compartment like this one, perched atop your car, will take care of the overflow. Patterned after a regular car-top carrier, the compartment is held to the car with rubber suction cups and woven straps which hook to the car gutters. Plywood, $\frac{3}{4}$ in. thick, is recommended for the side members of the framework. Both sides are joined together with stretchers fitted flush in notches, after which the top of the completed framework is covered with tempered hardboard and trimmed with stainless-steel molding.



Curved shape reduces wind resistance to the minimum



AIR CONDITION YOUR HOME

HOME AIR CONDITIONING is not "just around the corner," it is here in neat, packaged units available to any homeowner at a cost that approximates the cost of a forced-air furnace. This cost is for the unit alone, exclusive of installation. If, at first thought, an expenditure of this size seems rather high just to be cool on a few hot days during the summer months, consider the advantages of air conditioning which are much more than mere cooling. It enables you to keep your home closed and thus exclude dust and noise—an important consideration if you live in an industrial area. It controls humidity which, when excessive, is an enemy of health and home. Excessively high humidity not only aggravates certain human ailments, but it damages stored clothing, rusts metal parts and causes expansion and contraction of wooden parts which result in warped timbers and cracked plaster, as well as floor boards that spread or buckle at the joints.

In addition to its advantages, air conditioning floods your home with clean filtered air that reduces the misery of persons suffering from hay fever and other respiratory conditions caused by foreign matter in the air.

With these and many other advantages it can provide, air conditioning is rapidly becoming as much a part of the home as the heating plant or running water. In fact, many manufacturers are going into production of small year-round air-conditioning units. These range in size from 1 ton upward and consist of a forced-air furnace and an air conditioner individually packaged, but made to match so they can be used separately or as a unit. In this way, the furnace unit may be installed and the air-conditioning unit added later to produce a neat combination that takes little floor space. However, the conditioning unit may be added to any existing forced-air furnace.

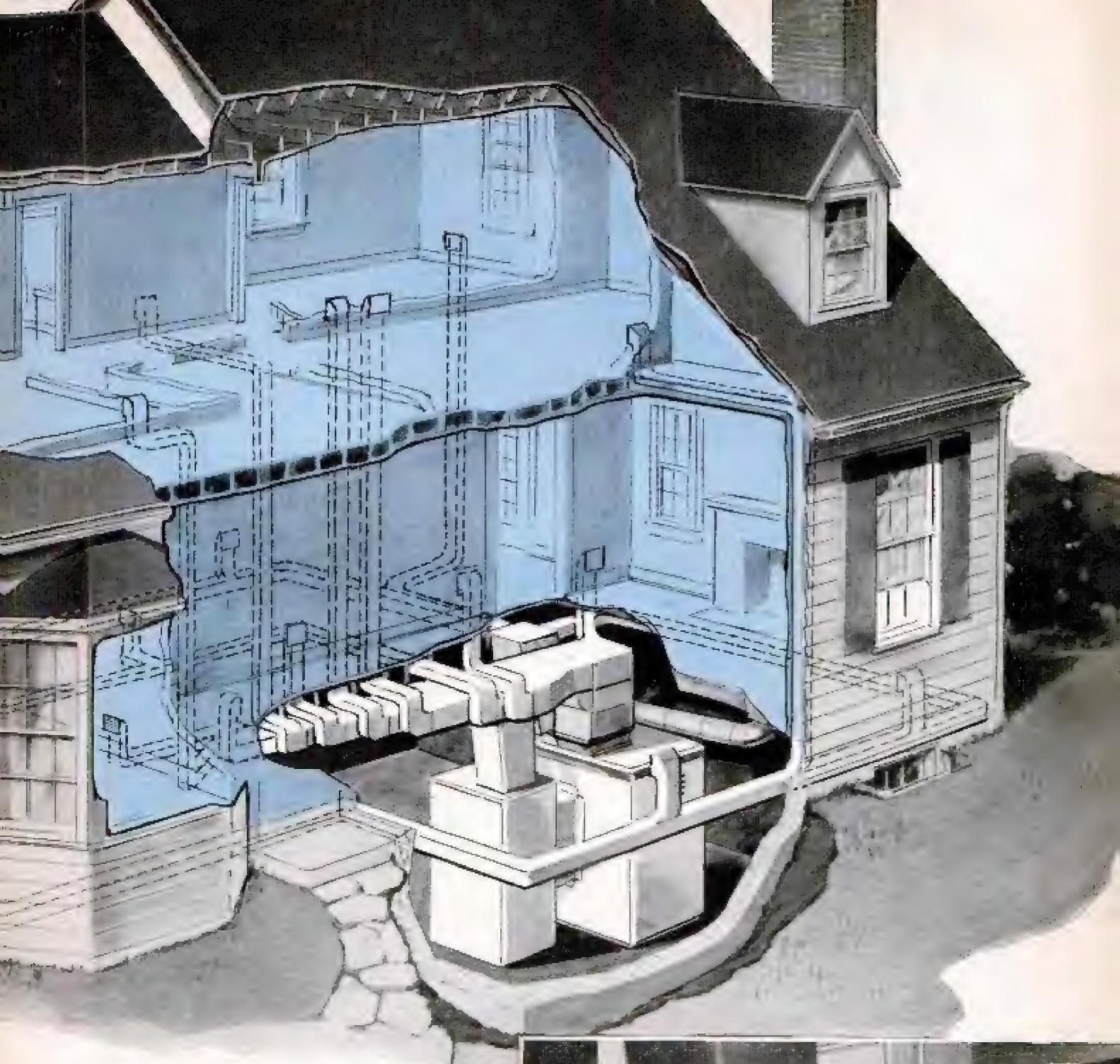
In the belief that the small units could be installed in the average home by the owner himself, the Craftsman editors of *Popular Mechanics* commissioned a young couple, Mr. and Mrs. Henry Windsor III, to do the job themselves. Their home is pictured in cutaway view showing the original furnace and duct system. While this home is slightly larger than the average, being a story and a half and containing approximately 1500 sq. ft. of floor space as com-



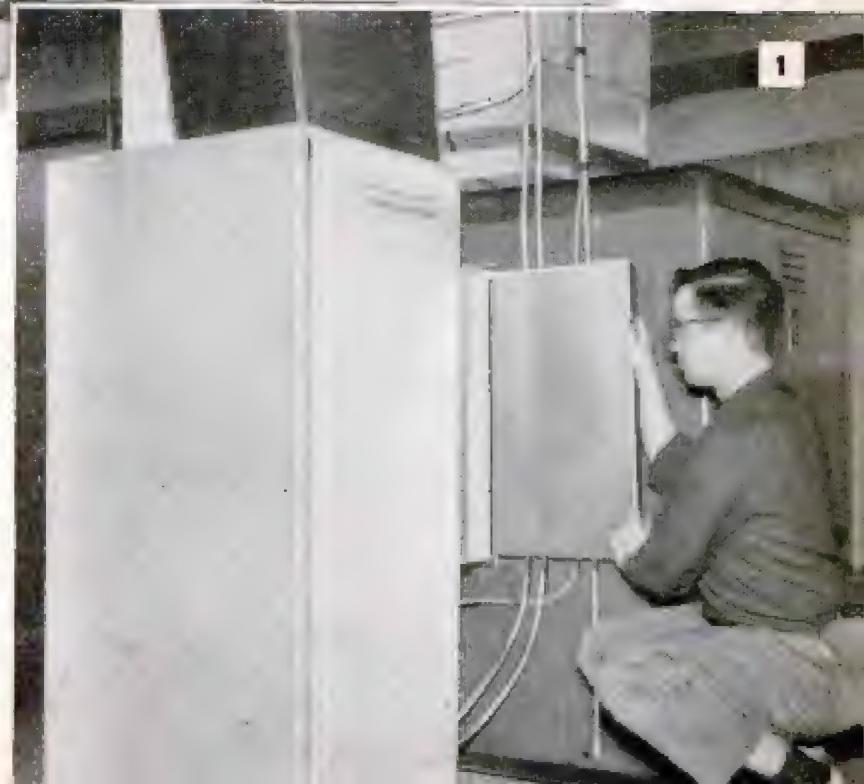
pared to approximately 1100 for the average five-room home, it was typical in that it was several years old and had a forced-air heating system of the general type that could be found in thousands of homes over the country.

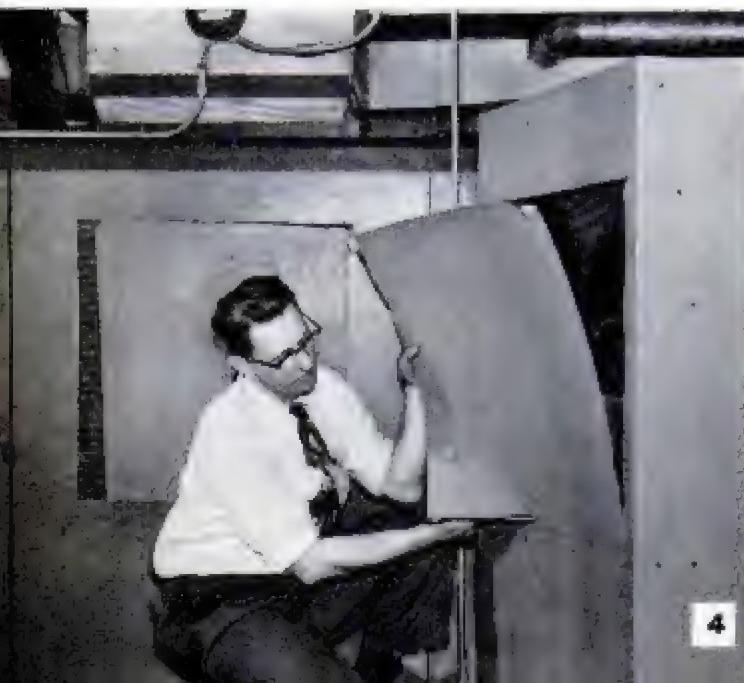
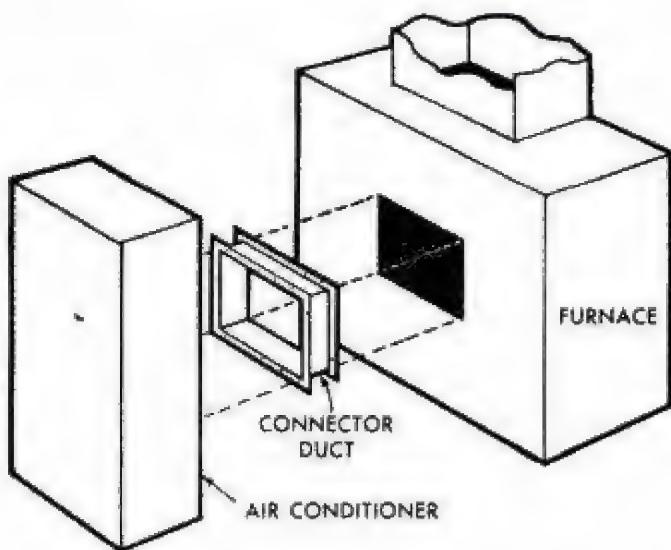
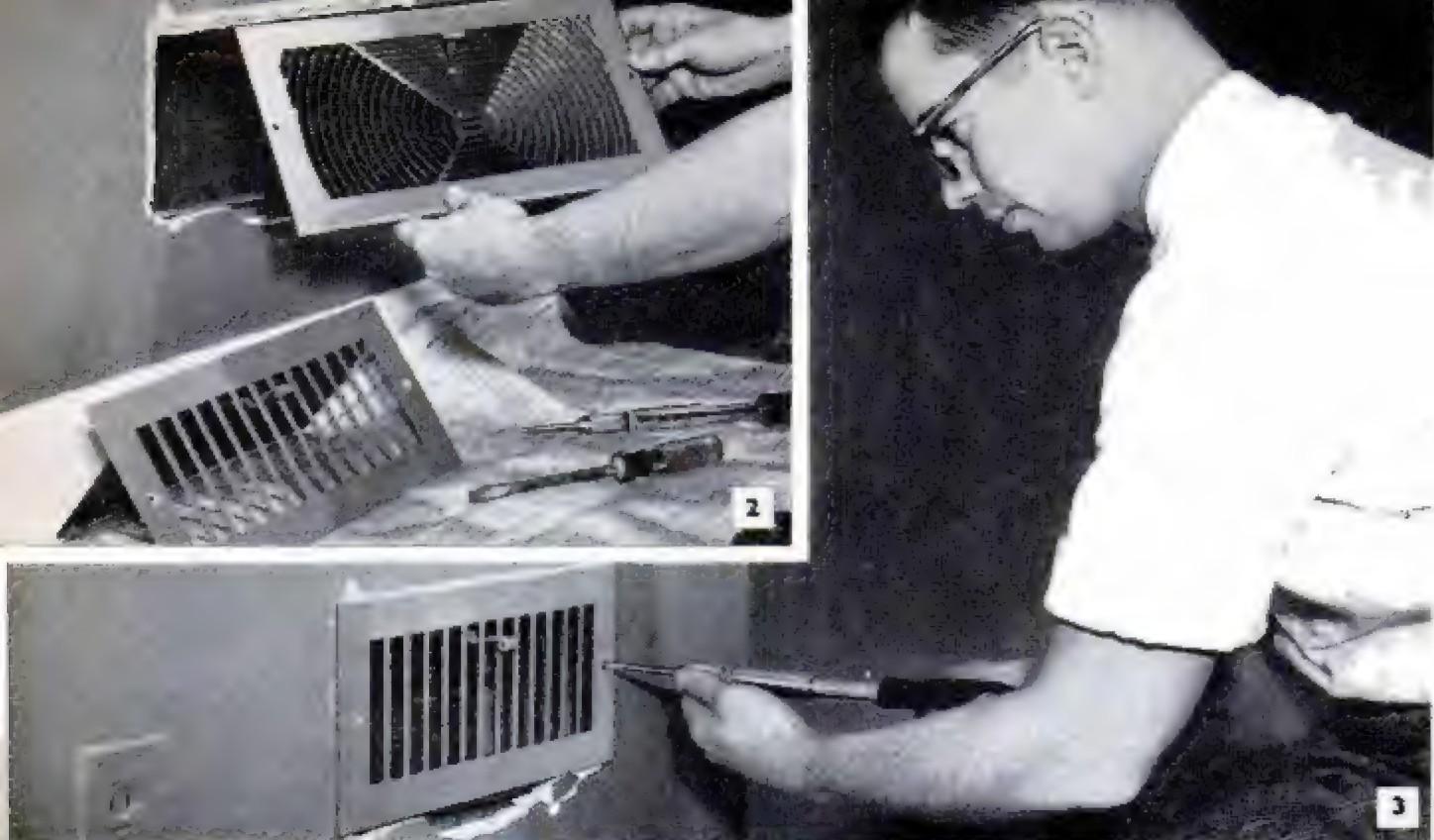
After consulting with air-conditioning engineers of General Electric Co., the Windsors (Hank and Mary) learned that the job would be relatively simple. Briefly, the job would amount to connecting the unit into one side of their furnace and into the furnace-duct system; running 220-volt current to the compressor motor of the unit and a water line to and from the compressor to cool it. There are many air-conditioning units on the market from which to choose. Hank and Mary picked the General Electric because it was small in size, took little floor space and seemed to fit their needs perfectly.

The next step was to obtain the correct

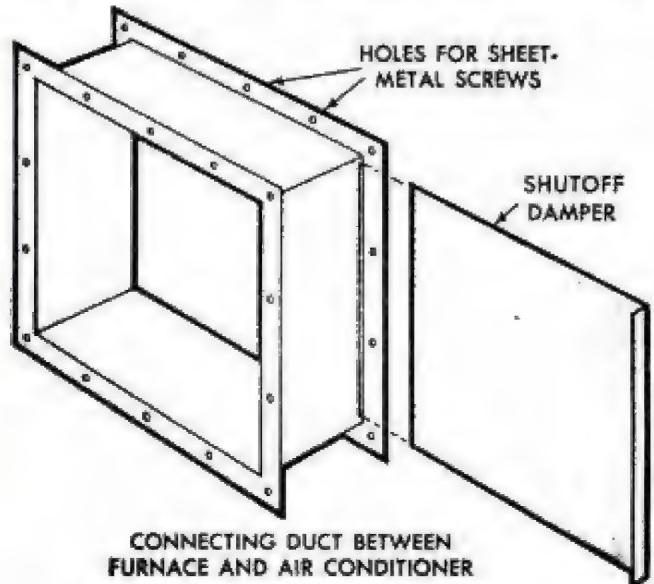


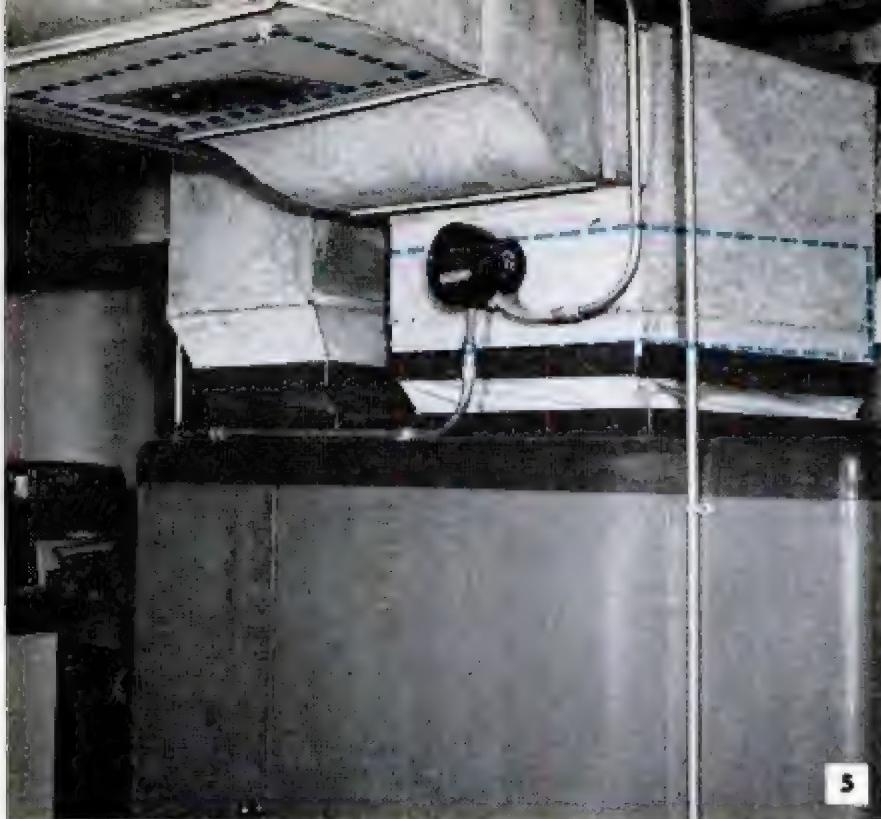
size of unit for their home. Selecting an air-conditioning unit of the right size is similar to selecting a heating unit. The cubic area of the home to be heated, the amount of glass and doorways, as well as thoroughness of insulation had to be taken into consideration. Also, maximum outside temperatures were a factor. Like heating, air conditioning is affected by the amount of glass, doors and insulation in the home. In heating, of course, infiltration of cold air and the passing of cold through glass, walls and doors determine the size of the heating plant. In air conditioning, the infiltration of warm air through the same





sources determines the size of the air conditioner. Since sizing the unit is rather complicated for the average person, although it is very important in industrial installations where large air volumes are dealt with, Hank learned that engineers had simplified sizing for homes by taking averages and building the units accordingly. In other words, if you had an average four or five-room home with average insulation, a 1 or 1½-ton unit would do. For a six or seven-room home, a 1½ or 2-ton unit would do the job. If you live in a climate having hotter and longer summers than the Chicago area, it likely would be necessary to increase the above sizes slightly. Your local air-conditioner dealer can aid you in picking the correct size. It is better to have the unit slightly undersized than oversized. If it is oversized, the air passing over the cooling coils will not keep their temperature high enough to prevent ice





forming on the coils. Hank found that a 2-ton unit would handle his home, which had the usual number of windows and doors for a house of that size.

Hank and Mary were now ready to go to work. They started with the register faces.

Existing registers were at floor level and shot the air straight out into the rooms. In order to get the air to rise, the register faces were replaced with a type that direct the air upward and to the sides. In other words, it blanketed the wall with cool air which was driven to the ceiling where it spread and fell to the floor. In this way, the room was cooled without evidence of drafts on the occupants. Figs. 2 and 3 show the type of registers used for the original

equipment and the type installed. The register in Fig. 3 is of the type that is found in many forced-air heating plants, while the register in Fig. 2 is the type used for the air conditioner. To be sure that the new register faces would not upset the heating plant, temperatures were taken over a period of time as a check. These are shown in the table of Fig. 8. As you can see, the new registers even improved the heating of the home and distributed cool air without drafts.

The next step was to install dampers in the existing plenum of the furnace and the duct connecting the furnace and air conditioner. Since the furnace blower moves air for both units, dampers are necessary

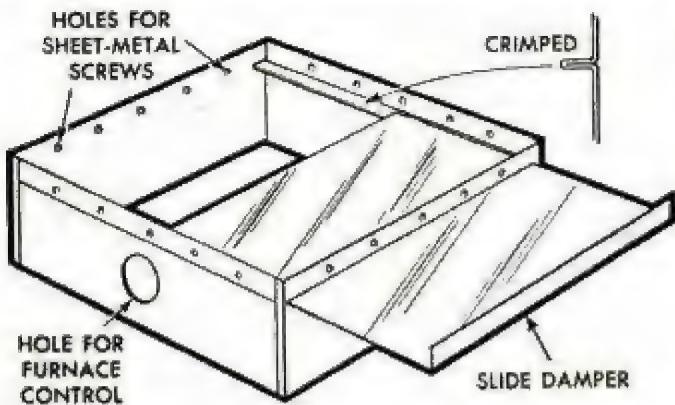
ROOM-TEMPERATURE READINGS BEFORE AND AFTER CHANGING REGISTERS

| | | Center | L.S.E. | L.S.W. | L.N.W. | L.N.E. | U.S.W. | U.S.E. | U.N.W. | U.N.E. |
|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| LIVING | BEFORE | 75° | 75° | 74° | 74° | 74° | 78° | 78° | 78° | 78° |
| | AFTER | 75° | 70° | 71° | 71° | 71° | 75° | 75° | 75° | 75° |
| DINING | BEFORE | 75° | 74° | 74° | 73° | 73° | 76° | 76° | 75.5° | 75.5° |
| | AFTER | 76° | 72° | 72° | 70° | 70° | 75° | 75° | 75° | 75° |
| KITCHEN | BEFORE | 76° | 72° | 72.5° | 73° | 72.5° | 76° | 76° | 76.5° | 76.5° |
| | AFTER | 78° | 73° | 74° | 71° | 72° | 77° | 79° | 78° | 78° |
| BATH | BEFORE | 70° | 68° | 68° | 68° | 68° | 72° | 72° | 72° | 72° |
| | AFTER | 72.5° | 67° | 67° | 67° | 67° | 74° | 74° | 74° | 74° |
| DEN | BEFORE | 72.5° | 69° | 69° | 68° | 68° | 73.5° | 73° | 74° | 74° |
| | AFTER | 74° | 72° | 70° | 70° | 70° | 77° | 77° | 74° | 74° |
| N.W. BEDROOM | BEFORE | 74° | 70.5° | 70.5° | 70° | 72.5° | 74.5° | 74.5° | 74° | 74° |
| | AFTER | 75° | 73° | 73.5° | 72° | 75° | 75° | 75° | 75° | 75° |
| UPSTAIRS BATH | BEFORE | 74° | 72° | 72° | 72° | 72° | 76° | 76° | 76° | 76° |
| | AFTER | 79° | 74° | 74° | 74° | 74° | 79° | 79° | 79° | 79° |
| N.E. BEDROOM | BEFORE | 72° | 70° | 72° | 70° | 70° | 73° | 72° | 72° | 72° |
| | AFTER | 75° | 73° | 72.5° | 73° | 73° | 76° | 76° | 77° | 76° |
| MASTER BEDROOM | BEFORE | 75° | 73° | 73° | 73° | 73° | 75° | 75° | 76° | 75.5° |
| | AFTER | 75° | 72.5° | 73° | 72° | 75° | 75° | 75° | 75° | 75° |

L.S.E.=temperature near floor at southeast corner. U.S.E.=temperature near ceiling at southeast corner



Above, Hank tests slide damper in plenum preparatory to starting up air-conditioning unit. Damper is part of sheet-metal unit shown in the detail below



Below, Mary lends a hand by driving sheet-metal screws to attach damper unit in plenum while Hank drills the pilot holes. Mary found many jobs on the project when Hank needed more than two hands



to control the flow of air through both the conditioner and furnace. The connector duct between the furnace and air conditioner is shown in details above Fig. 4 and to the right of it. This is made of sheet metal and fits over openings which you cut in the side of the conditioning unit and the furnace as pictured in Fig. 4. The duct can be made at your local sheet-metal shop. When you cut through the outer casing of the furnace, another casing, or baffle, will be exposed which also must be cut through. Be sure to cut the opening into the delivery section of the furnace, which is the section where the air is forced into the duct system.

Size of the connector duct will be determined by the size of the plenum that delivers air into the ducts. It should be of equal size or a little larger than the plenum if possible. The opening in the air conditioner is cut in the side next to the cooling coils so that when the air is forced from the furnace into the cooling unit it will pass over the coils and out the top of the unit to the duct system. Positioning of the opening in the unit will vary with different makes of units. In the General Electric unit, it was cut and positioned as shown in Fig. 4. As you can see in the details, the damper in the connector duct is nothing more than a piece of sheet metal that slides into a slot at one side of the duct to completely close the opening. This damper prevents air from passing through the cooling unit when the furnace is being operated.

In order to prevent flow of air through the plenum and into the duct system, thus bypassing the conditioner when it is in use, a damper similar to the one in the connector is installed in the plenum. To do this it will be necessary to cut a section from the lower end of the plenum and replace it with a connector similar to the one shown below Fig. 9. This connector also is made of sheet metal and is fitted with a slide. Fig. 10 shows the installation. Here Mary drives the sheet-metal screws while Hank drills the pilot holes.

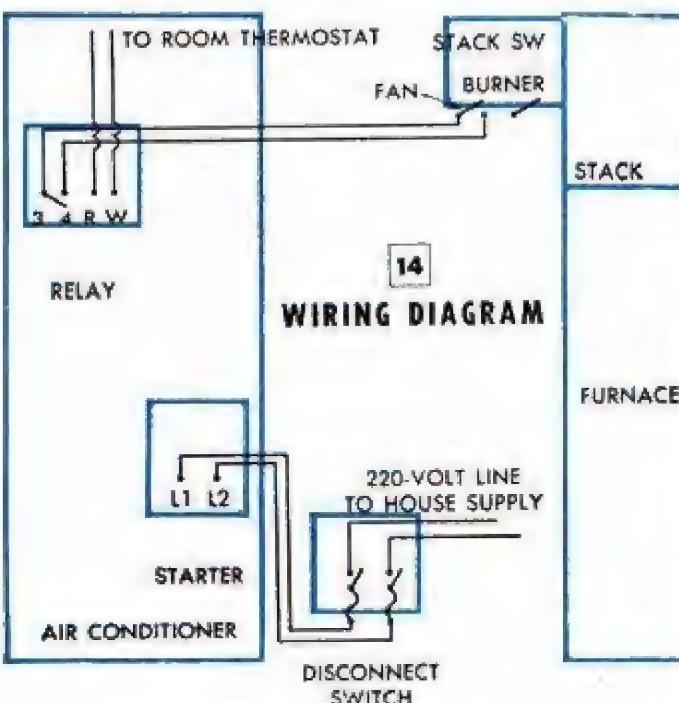
The next step is to connect the conditioner into the duct system. This requires cutting an opening in the main duct as close to the furnace as possible and directly above the conditioner. This opening is shown in Figs. 6 and 7. A large sheet-metal duct is then connected between the opening and the top of the air-conditioning unit from which the cold air is exhausted. Shape and size of the duct will vary with different types of conditioners and different installations. However, the idea is to get a duct running from the top or exhaust part of the conditioner into the duct system, being sure the connection is made between the furnace and any branch ducts taking off from the main one. If you have ducts going

in different directions directly from the plenum, it will be necessary to provide a duct to direct the air into the plenum above the shutoff damper.

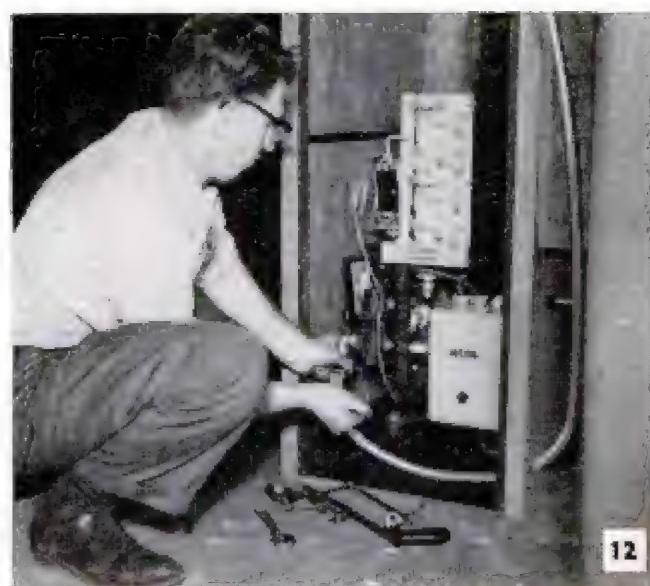
Once all of these connections are made, you are ready to run a water line to the compressor of the conditioner to cool it, or carry away the heat absorbed from the house by the air being blown over the cooling coils. Most home air-conditioning units are water cooled, although some are now being manufactured to be cooled by air. Fig. 11 shows how the water line is connected into an existing water line in the basement. The new water line can be copper tubing or pipe, preferably copper tubing since it is much easier to install. Fig. 12 shows how the line comes in at one side of the conditioner housing and connects to the compressor. An exhaust line for the water is also connected at the compressor and then carried to a drain.

Since an air conditioner has a 1-hp. or larger motor, it will be necessary to use a 220-volt circuit in the house. If you do not already have this, one will have to be provided. Hank already had 220-volt current and had a friend who was an electrician install a circuit as in Fig. 15. Fig. 14 shows the wiring system. This may vary somewhat with various installations but, in general, you can follow the one shown. Likely, it will be necessary for an electrician to run the line and make the connections to the unit for you. Fig. 5 shows the original furnace-stack switch relocated and rewired to operate both units. Fig. 13 shows the two thermostats that are necessary.

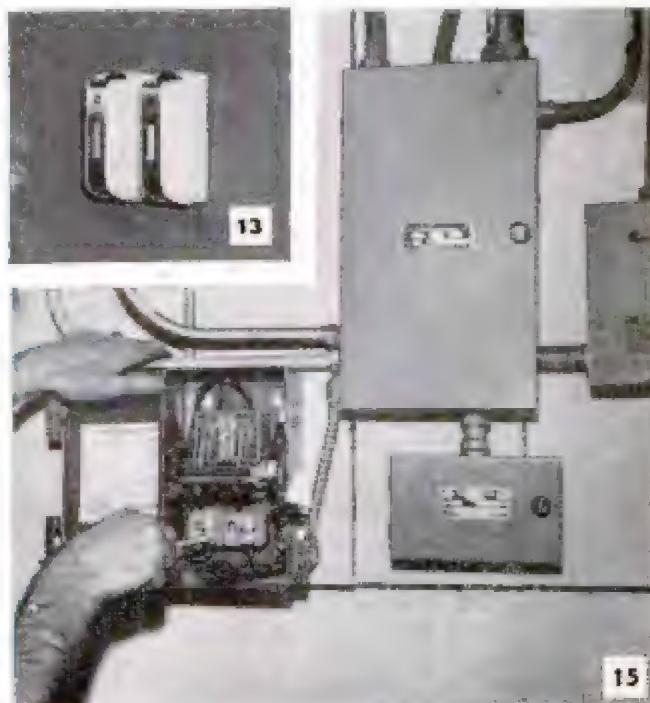
With the job completed, Hank readies the conditioner for a test run by pulling the damper in the connecting duct, Fig. 1, and closing the one in the plenum. ★ ★ ★



Connecting the copper water line to the cooling unit into an existing water line in the basement



Above, copper water line being connected to the compressor. Below, 220-volt line to operate compressor is being connected into service fuse box of home





Molding Fitted in Ceiling Corners Without Use of Miter Box

Moldings can be fitted neatly into corners without cutting them in a miter box or using a coping saw by butting them against a small block of wood, as in the photographs. The block is the same width and thickness as the molding and is nailed in the corner before the molding is put up. If carefully done, the finished effect of this corner treatment is unusual and quite decorative.—Michael Ligocki, Gary, Ind.

Storing Model-Airplane Cement

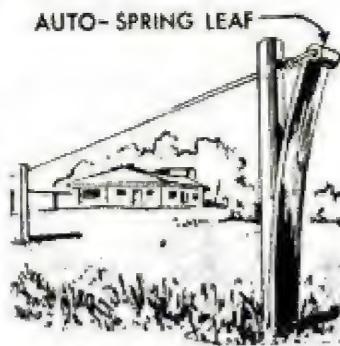


lacquer thinner into an ordinary jar and suspend the tube inside the jar with a short length of wire hooked over the rim. To keep the thinner from evaporating, use tin foil held in place with a rubber band to seal the top of the jar.—Ed Packer, Chicago.

Dirt particles will not cling to a dustpan if it is first given a coat of wax.

Leaf Spring Maintains Tension On Single-Wire Fence

The sagging of single-wire fences can be avoided if the fence wire is attached to an auto-spring leaf as shown. The wire is passed through holes drilled in pipe stakes and attached at one end to the spring, which is driven firmly into the ground at the side of the end post. If drawn tight when first attached, the wire will be held under tension by the spring indefinitely.



"Squeeze" Bottle Sprays Cleaner

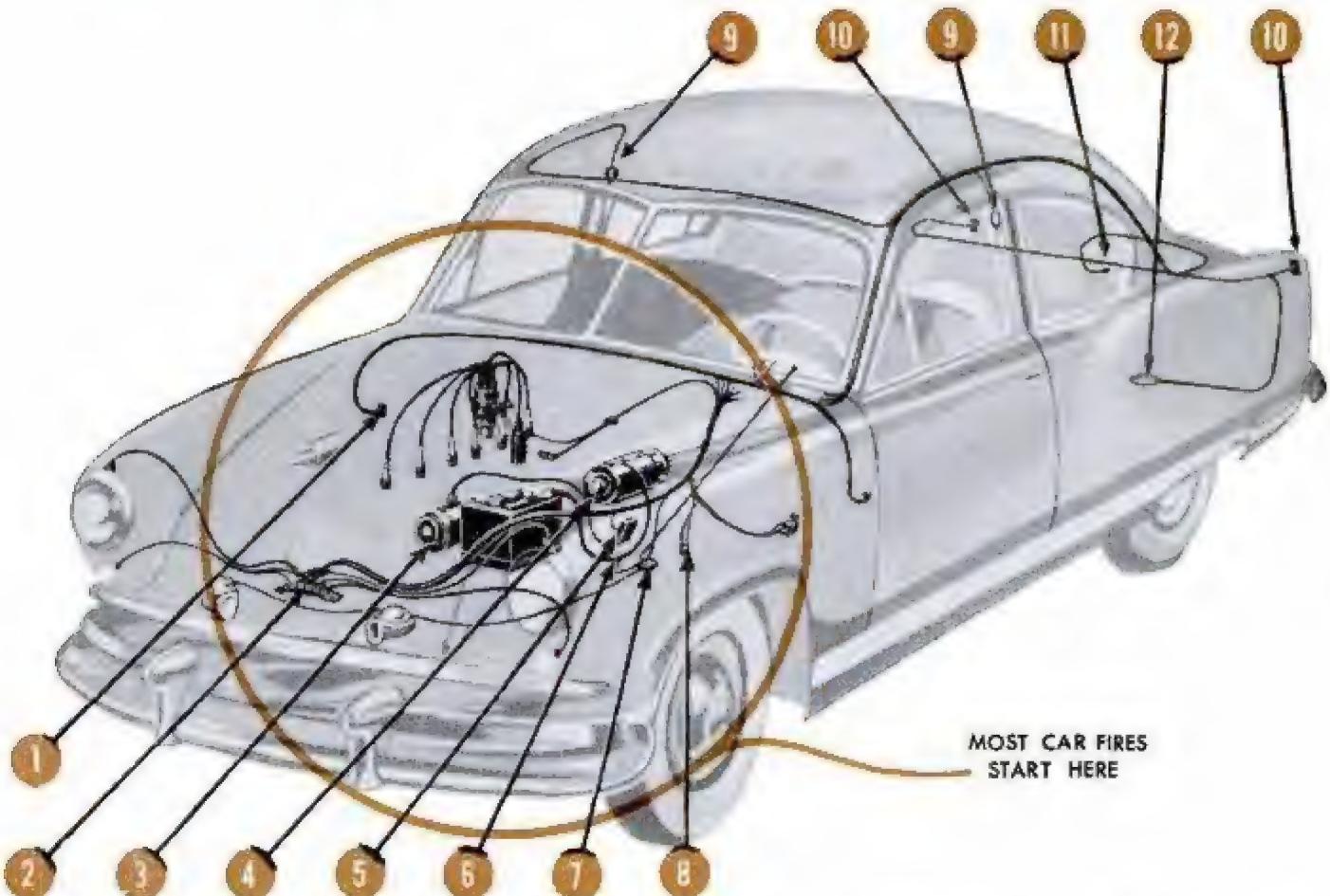
Instead of throwing away an empty plastic "squeeze" bottle of the type in which various lotions and spray deodorants are sold, one car owner keeps one on hand for spraying window-cleaning fluid on the windows of his car. First, he removes the stopper, rinses out the bottle and then fills it with the fluid. Then he replaces the stopper and has a spray bottle which is not only leakproof and unbreakable, but takes up little room when stored in the glove compartment.

Tapered Bit for Carving Plastics Improvised From Wood Screw

Easily broken from time to time, tapered bits of the type used for internal carving of plastics can be replaced by altering a long, slender wood screw. After cutting off the head, chuck the screw in an electric hand grinder and then run it against a file or abrasive stone, as indicated, to flatten the threads. The improvised bit will not be as sharp as a regular plastic drill but will enable you to do a satisfactory job, provided you do not try to force it into the work.

Ken Murray, Colon, Mich.



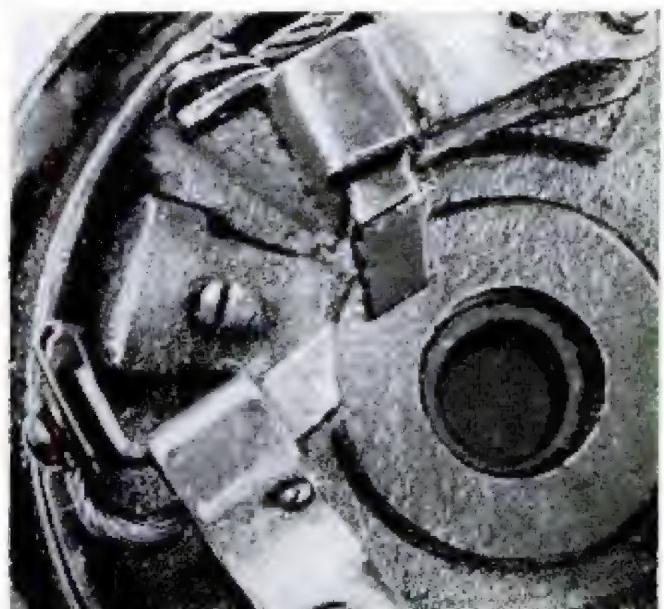


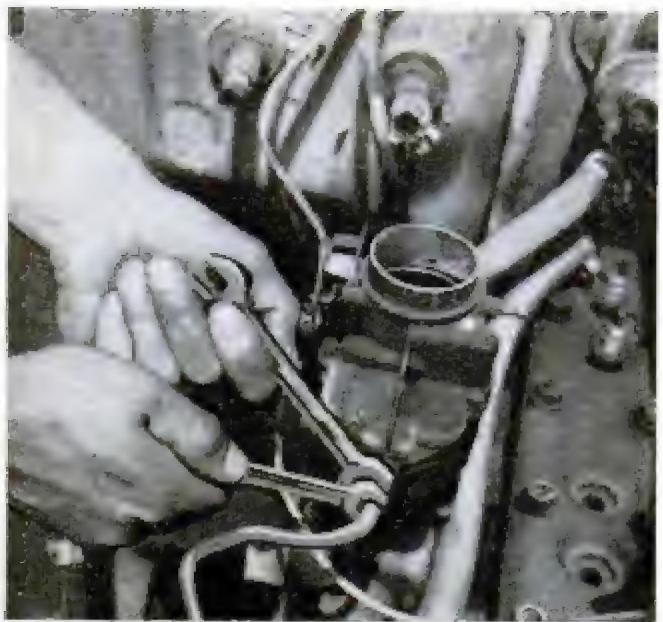
Don't Let a Car Fire Start

By Ed Packer

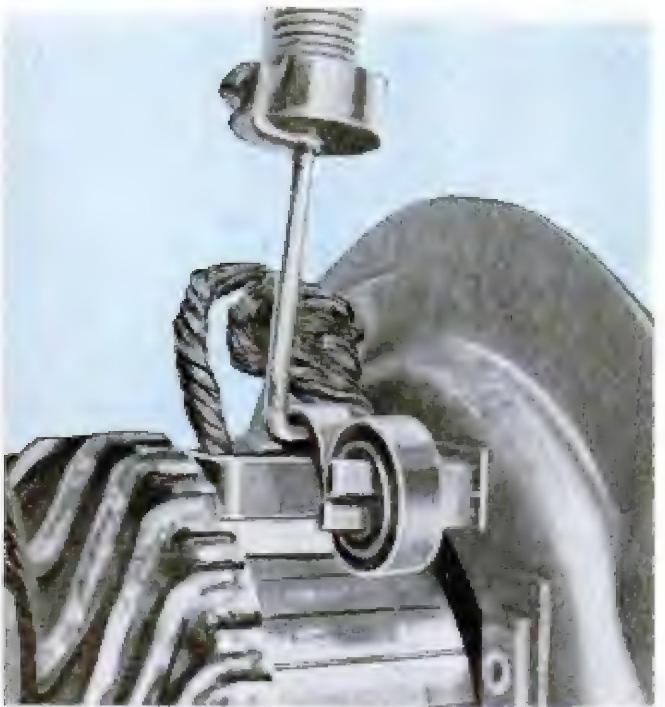
IN THE EXPERIENCE of the average owner, the possibility of a serious car fire is so remote that it invites neglect of simple precautions. Periodic inspections will catch common electrical and mechanical defects before they develop into potential fire hazards. Nearly all car fires originate in the area enclosed by the circle in the illustration above, but note that points 1 to 12 inclusive include all wiring terminals

and switches. Probably the greatest danger is in a concentration of gasoline vapor being ignited by an arc caused by a defect in the electrical system. However, there are possible causes of car fires not directly due to common electrical defects. For example, changes in temperature may cause the engine to "sweat." The spark plugs will become coated with moisture, forming a path for the high-tension current which may arc





Always use two wrenches when tightening or loosening compression fittings to avoid damaging fuel line. Use of one wrench may open tube and cause slow leak



Above, checking brush-spring tension. Worn brushes, weak springs cause arcing. Below, check battery carrier often. If defective, it should be replaced

across the porcelain insulators when you close the ignition switch and step on the starter. These arcs can ignite gasoline vapors which tend to collect under the hood if there is a slight leak in the fuel line or at the carburetor. Of course, this danger is remote, but it should never be overlooked. When temperature changes cause excessive sweating, it's a wise precaution to dry the plugs before starting the engine. Never neglect a rusted muffler. Replace it, as in the left-hand photo on the preceding page, and also the exhaust and tail pipes if these parts are defective. There is always the danger that sparks from these defective parts may ignite gasoline spilled from the filler neck of the fuel tank. Never permit the fuel tank to be filled above the lower end of the filler neck. A lower level is safer on warm summer days.

Overoiling starter and generator bearings can result in the condition shown in the lower right-hand photo on the preceding page. A coating of oil on the brushes and holders may cause a continuous arc. If inspection shows an oil coating, such as that pictured, the unit should be thoroughly cleaned with a solvent. The brush tension also should be checked as in the center photo at the left. Replace the springs if they are weak.

Another precaution that should be observed by mechanics and owners alike is to use two wrenches when tightening or loosening compression fittings on the fuel lines. See the upper photo at the left. Use of one wrench may distort the line sufficiently to cause a slow leak.

Whenever an inspection is carried out, be sure to take a close look at the battery carrier, lower left-hand photo, and if it's defective, replace it. Clean the cooling system periodically; otherwise sediment may collect in the engine block and cause over-

Sediment like this can clog small passages in the engine block. Affected areas may heat to extremely high temperatures and create a potential fire hazard



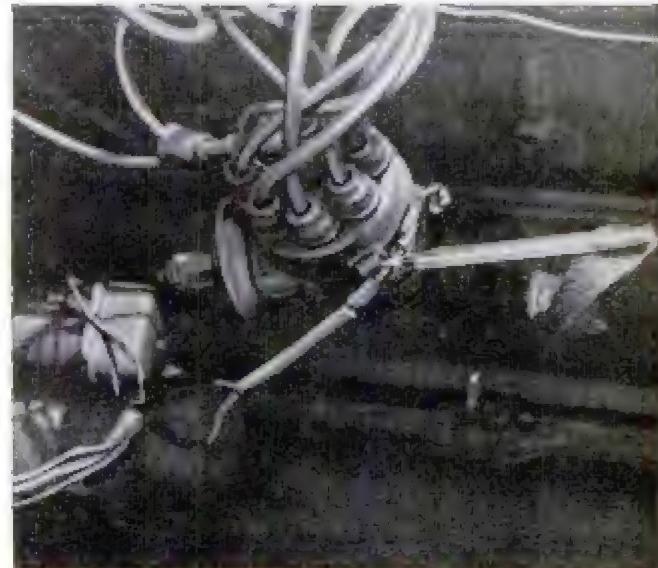
Right, it's a good idea to have chassis of an older car steam-cleaned thoroughly at regular intervals

heating. See the lower right-hand photo on the opposite page. It's a good idea to steam-clean the chassis occasionally as pictured at the right, especially on an older car. One of the best precautionary measures against the possibility of fire in any car, new or old, is simply to keep the engine and chassis reasonably clean.

Both center photos below and the one at the lower left show typical examples of defective wiring frequently found in older cars. The bared wires in the lower left-hand photo started a serious fire. Even an armored cable, center left-hand photo, will wear through in time if it rubs against metal. Many car owners equip the battery ground cable with a quick-detachable clamp such as that shown in the lower right-hand photo. This provides a means of breaking the circuit quickly in case of a short in the electrical system. ★★★



Even armored cable can wear through in time if it rubs against metal. Support cables in metal brackets



A wire bared like this one will spark regularly if it touches metal. May cause fire if fuel vapor is present

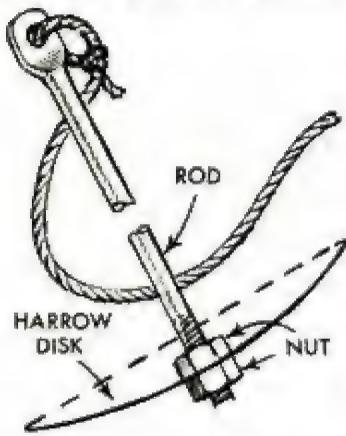
A bared wire in this "harness" caused a fire. New wiring would have been cheaper than repairing damage



Many car owners equip ground cable with quick-acting clamp so that circuit can be opened in an emergency



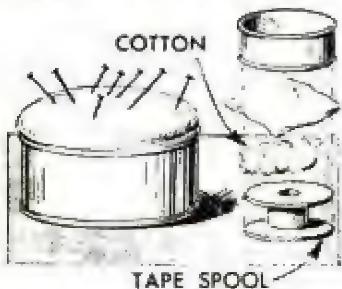
Boat Anchor From Harrow Disk



An efficient anchor for a small boat can be made by bolting a harrow disk to a length of rod which has been flattened and drilled at the other end. The anchor line can be attached directly to the shaft, or to prevent undue wear, tied to a clevis which is fastened to the shaft. To increase the anchor's weight, additional disks may be added. An anchor of this type also may be used to brace farm buildings. In this use, the disk is buried and the bracing cable fastened to the clevis.

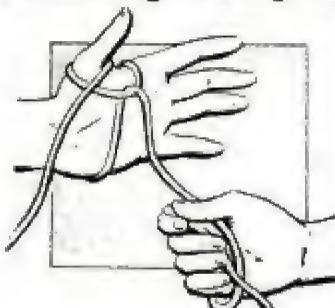
Howard E. Moody, Upper Jay, N. Y.

Tape Spool Becomes Pincushion



A common adhesive-tape spool, a piece of cloth and a wad of cotton may easily be assembled into a practical pincushion. With the outer shell of the tape spool removed, a compact wad of cotton is placed on top of the spool and covered with cloth. The shell is then pushed down over the cloth, holding it smoothly and firmly in place. The protruding edges of the cloth are trimmed and the cushion is finished. To eliminate the possibility of the cotton working out through the center of the spool, the hole should be covered with cardboard before the cotton is placed over it.

Breaking String by Hand



To break string, twine or cord with your bare hands, first loop it around the left hand as indicated, then wind several turns around the right hand, pull up tight and give a quick jerk.

However, before doing this, be sure to close the left hand tightly over the string in order to hold the loops in place. With a little practice, it is a simple matter to determine beforehand almost the exact point where the string will break.

B. Franklin, Azusa, Calif.

LIGHTWEIGHT PLASTIC TENT

By George Thompson

THE ANSWER to every camper's dream, this waterproof and mildewproof plastic tent folds into a neat 7 x 10-in. bundle that is easy to pack and carry. It requires about 21½ yd. of 6-ga. vinyl plastic, 36 in. wide, and its total cost should be less than ten dollars. The plastic is cut with a pair of scissors, following the patterns shown, and then the seams are joined by "welding" them with a pressing iron set at the temperature normally used for ironing cotton. To provide additional strength, cotton-twill tape is sealed into the seams between the layers of plastic. A seam that contains ½-in. tape should be about 2 in. wide. An additional tape is sealed along the ridge of the tent and run down the front hood to form a loop for the guy line. At the lower edges of the tent, where the tape emerges from the seams to form loops for the stakes, the tape is sewn directly to the plastic with cotton thread. The tapes of the side seams are sewn together where they meet at the peak of the tent.

The tent is supported either by a length of rope strung between two trees as shown in the photograph or by a pole, plastic loops being attached to the ridge so that either method can be used. These loops are 6 in. or more wide, and made of four thicknesses of plastic sealed together with a layer of tape for reinforcement. Two loops on the outer side of the tent ridge are used for the rope support, and two loops on the inner side of the ridge for pole support. The pole used is T-shaped, 6 ft. high, with a crossbar 35 in. long.

Sealing the seams is not difficult if it is done carefully. One edge of the plastic is laid flush with the edge of a table, and the piece to be joined to it is brought up over the edge of the table. An overlap of the width desired is made, and then the iron is placed on the seam. It is pressed momentarily, then lifted and moved over to the next portion to be sealed. A little experimenting with the iron and some scrap plastic is necessary to set the temperature of the iron properly. If the iron is not hot enough, the seal will not hold. If it is too hot, the plastic will melt and stick to the iron. Touch the iron to two or more layers, but never to a single layer, as an iron hot enough to seal two layers will burn a hole in a single one.

Plastic pockets which are handy for stor-



Above, tent folds into compact package. Below, to join plastic panels, lay pieces at edge of table. Overlap and press iron on seam. Lift and move to next section



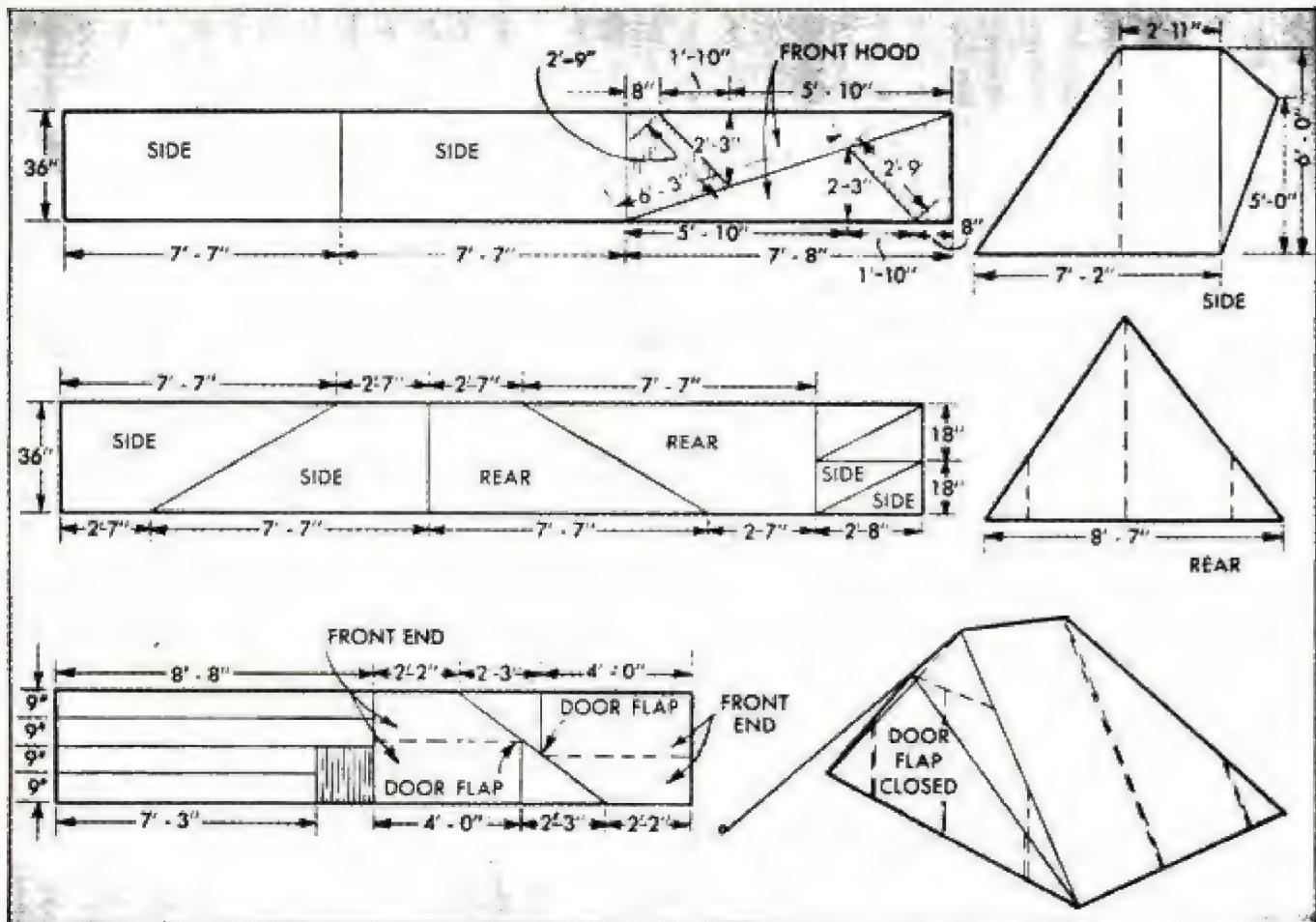
Tapes for tying flaps are made by folding wide piece of plastic six to ten times

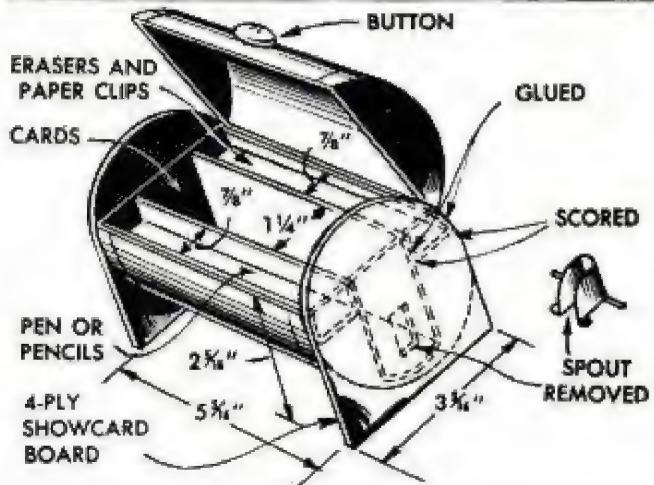


ing clothing, flashlights, watches and other camping gear can be welded to the walls of the tent in convenient places. Patterns for sod cloths, which can be attached to the sides of the tent, if desired, are given in the lower left-hand corner of the detail below. When the tent is put up, these are folded either toward the inside or the outside, and weighted with stones or lumps of sod to steady the tent sides. To protect the occupant of the tent from moisture and insects, a ground cloth, 8 ft. 7 in. x 7 ft. 2 in., is made from the same plastic material.

When put up, a plastic tent should not be stretched as tightly as a canvas one. It must be handled with some care, but if tape has been put along all lines of stress, and loops for the stakes have been placed close together, this tent will ride out a stiff wind with no trouble. Holes can be patched easily by using a small scrap of plastic in the same manner as an inner-tube patch. ★ ★ ★

Construction details courtesy of Scout Field Book, Boy Scouts of America





Kitchen File for Recipes From Empty Salt Box

This salt-box file will hold a collection of favorite recipes pasted on standard 3 x 5-in. index cards, and also provide trays for pencils, erasers, paper clips, etc. After removing the pouring spout from a cardboard salt box, a lid is made by cutting through the ends and one side of the box, and scoring the uncut side. The lid is bent upward with the scored side acting as a hinge. Adhesive tape along this side will reinforce the hinge. The insert is made of stiff cardboard, bent and glued as shown. The endpieces can be made from heavy cardboard such as 4-ply showcard stock or from hardboard or light plywood. A button may be added to the lid to serve as a handle. A coat of shellac, followed by a coat of paint or lacquer, will complete the file.

Frank Shore, New York City.

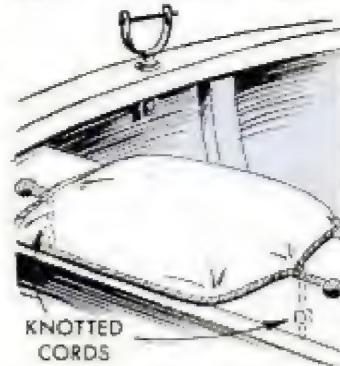
To secure wooden drawer knobs, shellac a piece of twine and wrap around the screws while still wet. Drive the screws inside the knobs and allow them to dry.

What About Cornices?

Have you noticed an elusive something that gives a friend's home a cozy interior appearance that is lacking in yours? The answer may be eye-catching cornices over windows, in alcoves or above bed headboards. Read the interesting story on cornices next month—it's sure to give you new ideas on decorating and dramatic lighting treatments.

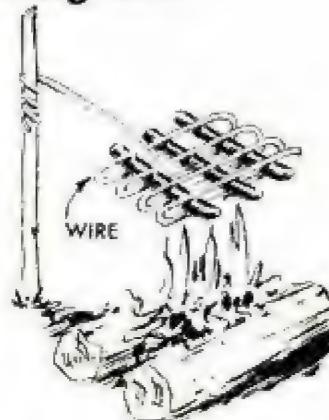
"Anchoring" Cushion to Boat Seat

If you dislike having a boat-seat cushion slip around or fall to the bottom of the boat, sew two lengths of light rope to the cushion seams at opposite sides to provide anchors. Leave one end of each rope free for a distance of 4 or 5 in. and knot it to drop through a keyhole slot, sawed in the seat. For a real nautical appearance, run the ropes around all four sides of the cushion, leaving the ends free as before.



Wire Wiener-Roasting Grill

A simple grill for roasting wieners can be formed by bending a length of heavy wire as shown in the illustration. The coiled end should fit snugly enough around a stick or a length of pipe to keep it from sliding, yet be adjustable. After inserting the wieners, the grill is swung horizontally over the fire and swung away when they are cooked.



Shadow Cast by Flashlight Beam Locates Tiny Part on Floor

Whenever I drop a small machine part or other tiny object on the floor, I simply darken the room and place a flashlight on the floor, rolling it slowly in a wide arc. As the beam falls across the object, a long shadow is cast just beyond it that pin points its location.—E. R. Robertson, Mitcham, South Australia.



AUXILIARY GANG-REEL REWIND

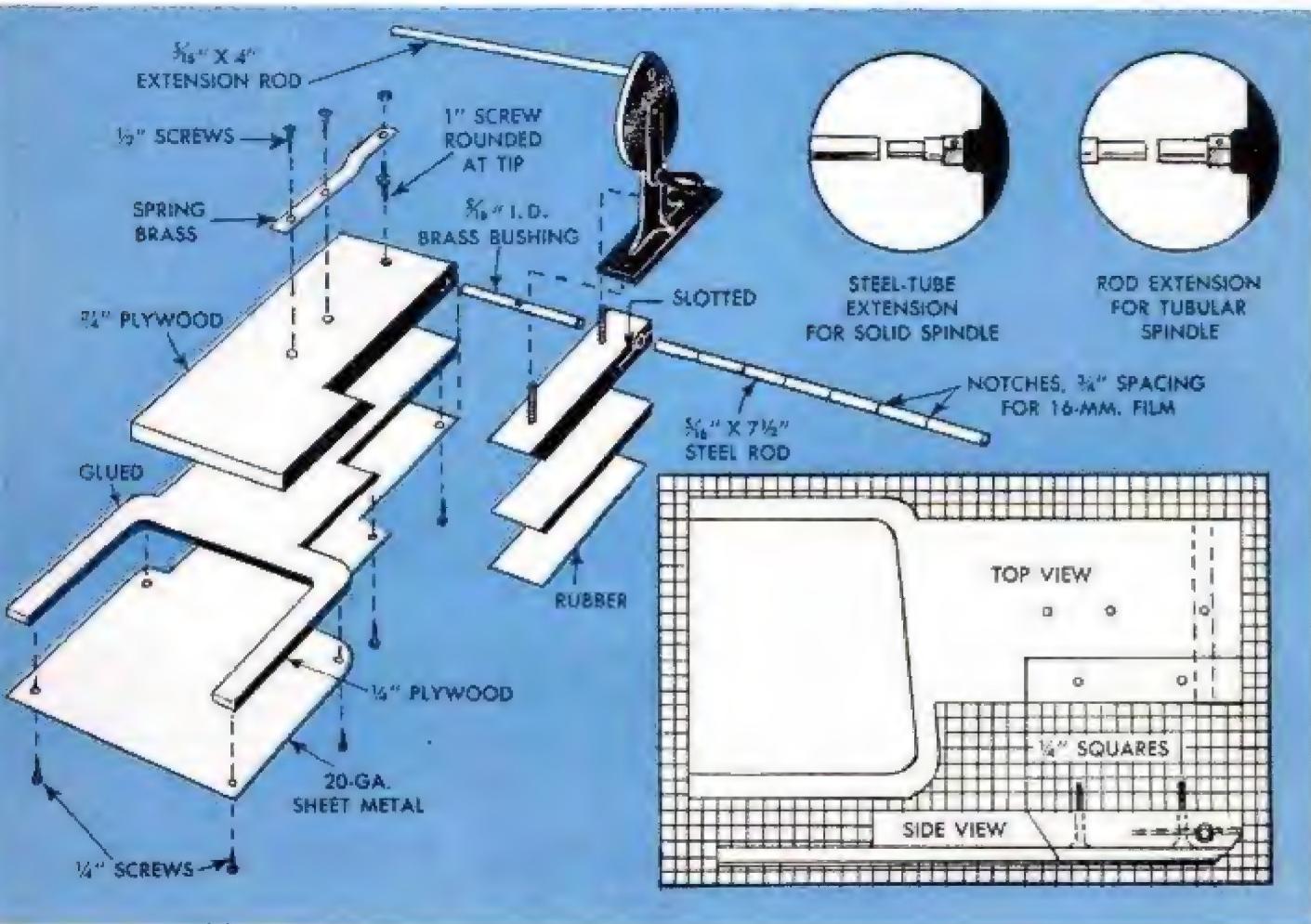
By M. G. Winterton

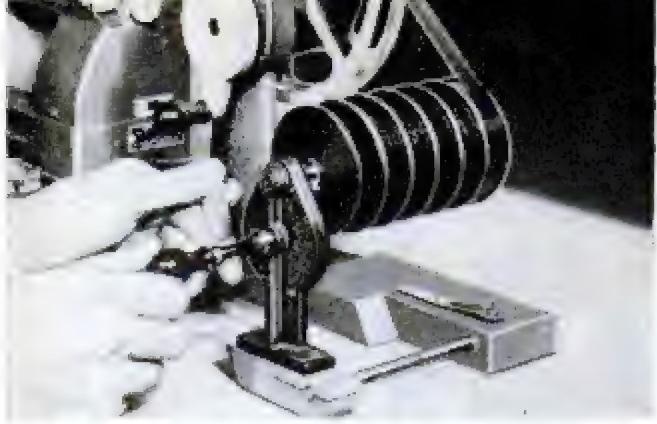
UNLESS YOU HAVE everything systematized beforehand, movie-film editing can produce a state of confusion difficult to correct by any ordinary means. The main problem, of course, is keeping track of scene sequences and also groups of related scenes which tell your story in pictures when properly edited. This gang-reel unit has been designed to speed up and simplify the job of editing picture sequences and also to keep the film in order should you be unable to finish the job at one sitting.

A method of adapting an ordinary rewind unit for use with the gang reels is shown in the details below. The rewind spindle is first fitted with an extension. Some rewinds have tubular spindles, others solid, and the spindle extension can be cut from a solid rod or tube as required. In

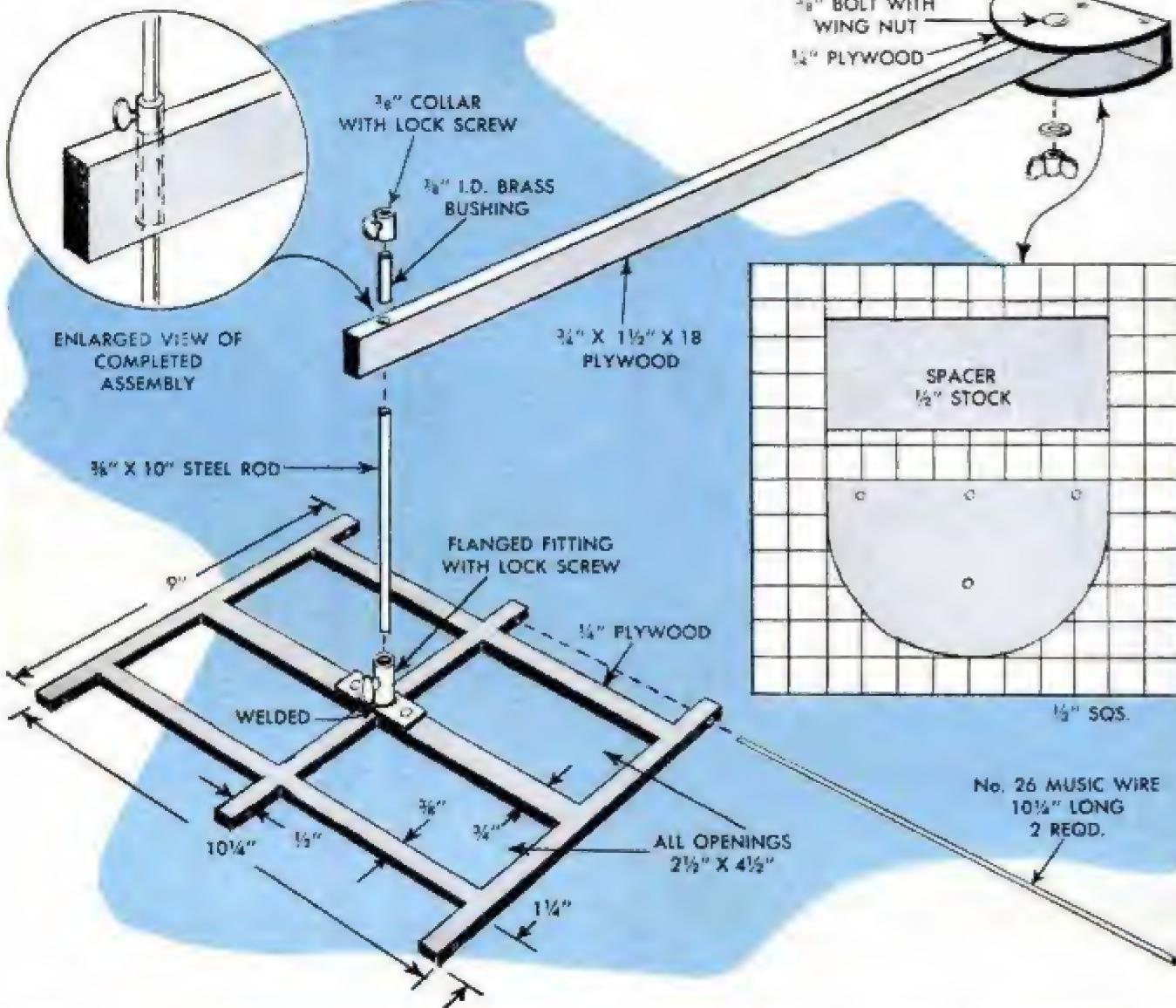
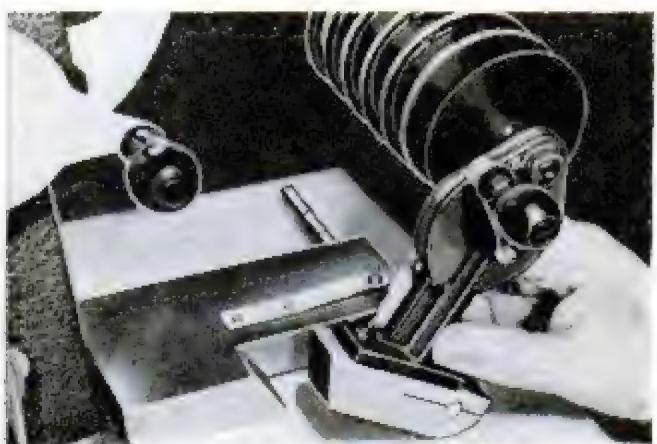


Gang-reel rack holds four gangs of six reels each and pivots on a bracket and arm attached to the wall

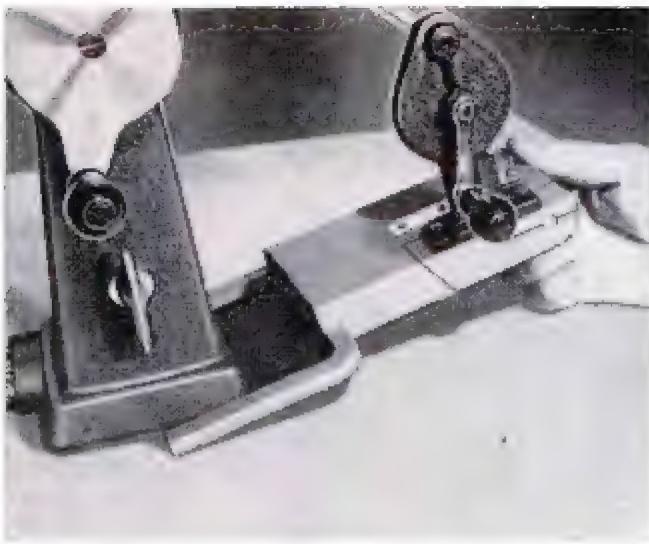




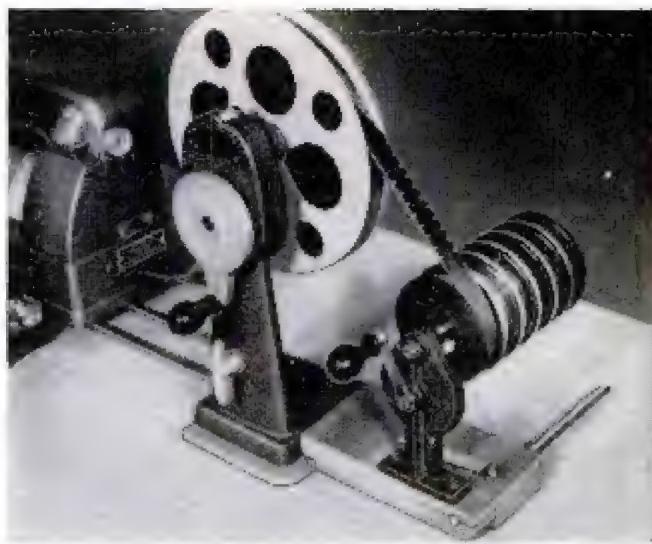
Above, gang-reel rewind is mounted on individual sliding base. Notched rod aligns gang reels with editor rewind. Below, click-stop holds unit in place



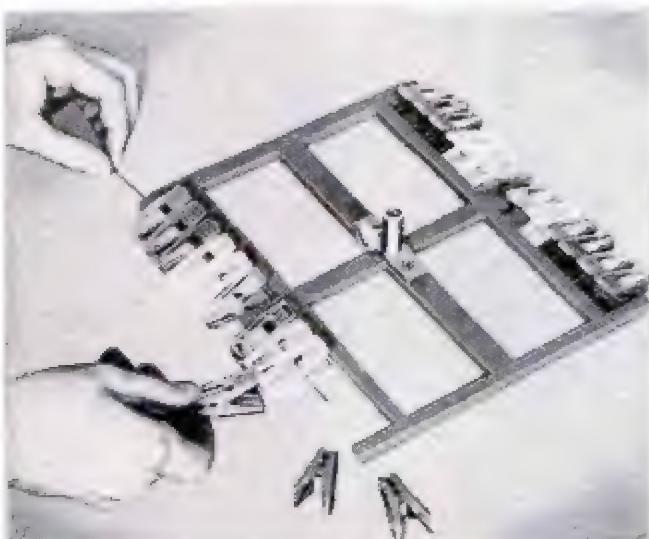
either case it must fit snugly. Then the rewind unit, with its spindle extension, is bolted to a pivoted base which, when assembled, becomes part of a larger unit designed to slip under the base of the film editor where it is held firmly in position. Now note in the photos at the left how the rewind, with the gang reel in place, can be moved in or out on its individual base to line up any one of the six reels of the gang reel with the editor rewind. Note in the details on the preceding page, that the base on which the rewind is mounted is drilled and slotted so that it clamps onto a notched metal rod which slides in a bushing in the top base member. The rod is held in any one of six positions by means of a flat spring-brass stop, the lower end of which projects through a hole drilled in the bushing. The stationary base, of which the rewind base is a part, consists of three members, the top and center pieces being cut from plywood and the bottom piece from sheet metal. The forward end of the center member is cut in the form of a yoke which fits around the base of the editor unit. Check dimensions of the latter before cut-



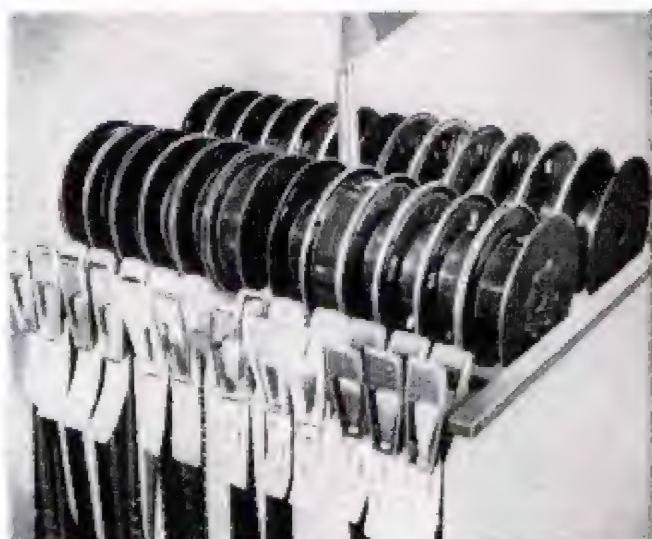
Here's the way the base of the gang-reel rewind is fitted under the base of the editor rewind. When in position, it is correctly aligned and is held firmly



In this position, the first reel of the gang rewind unit is lined up with the reel on the editor rewind. A click-stop spaces the gang reels automatically



Storage rack for gang reels is made of plywood. Center pivot permits turning the rack to any convenient position. Clothespins hold ends of the film in place



As the reel gangs are placed on the rack the film ends are attached to the clothespin clips with identifying tabs so scene sequences are always in order

ting this piece. The bottom of the stationary base is covered with thin sponge rubber or felt to prevent marring the table top or desk on which the unit is placed when in use. In the final assembly, be sure that the notched rod slides easily in the bushing.

The rack for storage of the reel gangs is detailed on the opposite page and pictured above. The gangs are built up by soldering or cementing the individual reels together and the rack has been designed to hold four gangs of six reels each. The rack

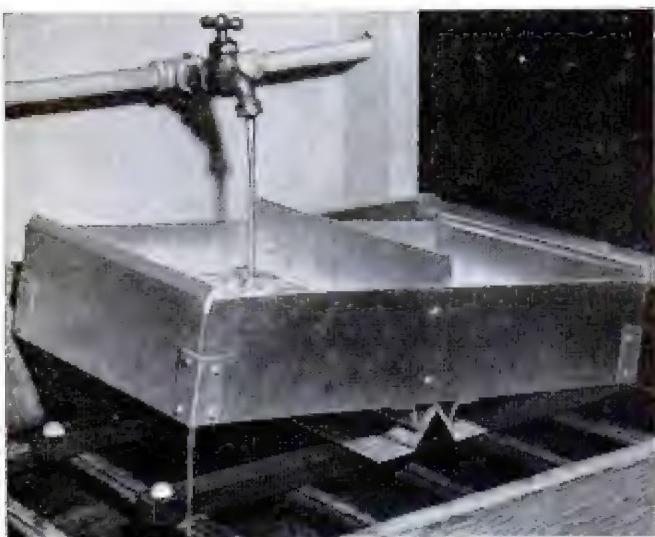
is cut from plywood, mounted on a swinging arm as indicated and also is pivoted on a rod so that it may be raised, lowered or turned to any convenient position. Four gang reels are stored in the rack and the free ends of the film are held by plastic clothespins threaded onto lengths of wire. As the film ends are clipped in place in the clothespins, paper tabs carrying identifying data are attached as in the right-hand photo above. In this way any individual film or continuity can be identified. ★★★

Stain Applied to Polished Metal Shows Scribed Lines Clearly

When laying out work on polished brass or steel, finely scribed lines and punch marks will become more clearly visible if the metal is coated with a stain. A suitable stain for this purpose can be made by mixing methyl violet, $\frac{1}{2}$ oz., and clear shellac, 1 oz., after which enough denatured alcohol is added to provide $\frac{1}{2}$ pt. of the solution.

When brushed on the metal, this stain produces a bright purple color on which the scribed lines stand out sharp and clear. If desired, it may be applied at an early stage to facilitate placement of punch marks and precise measurements. When finished, the stain can be removed by applying a solvent and then rubbing with steel wool.

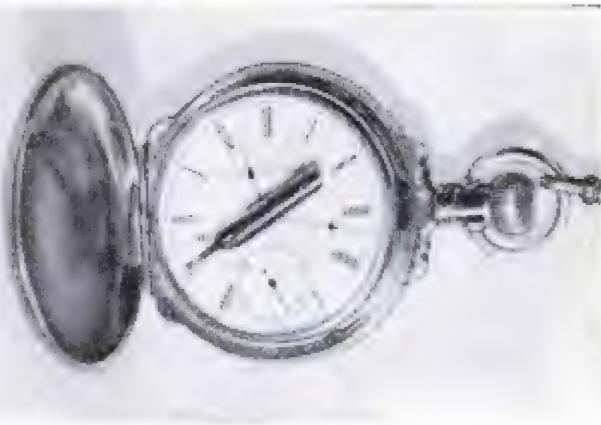
Water Flowing From Faucet Rocks Darkroom Print Washer



This simple rocker washer utilizes the flow of water from a faucet to motivate a seesaw action that removes the hypo from photoprints quickly and thoroughly. As the water rises in one basin, its weight tilts the rocker, changing the position of the center fin and diverting the water into the other basin. Gaps and holes are punched in the corner seams to permit the water to drain from the lower end, thus causing the action to continue automatically. The rocker is balanced on a galvanized-steel fulcrum that is mounted on two slats having rubber pads at both ends to cushion the rocker action. The basins are made of aluminum and measure 10 x 12 in.

Processing Time-Limit Reminder Provided by Penpoint

Photographers who use a pocket watch to time the washing of prints and negatives will find that a penpoint placed upon the crystal will provide a handy reminder for indicating when a period ends. On a wall clock or wrist watch, a narrow strip of tape will serve the same purpose. To make a pivoted pointer, run a thumbtack through a piece of masking or cloth-patching tape, with the head on the adhesive side, and push a cardboard pointer over the tack. Then you can press the tape on the crystal or remove it, as necessary.



Popular Mechanics Bookshop



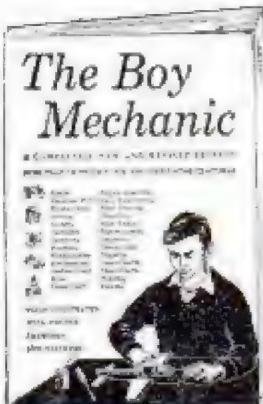
Shop Layout

Beginners as well as experienced shop workers will find a wealth of ideas on shop layout and care, benches and cabinets the homeowner can build himself, and tips on shop techniques in *Planning Your Home Workshop*. More than 450 illustrations show how to do it. The price is \$2.50



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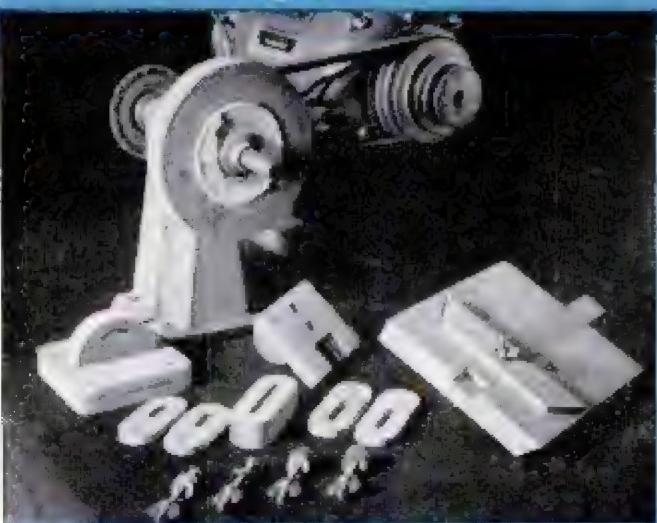


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SHOP NOTES

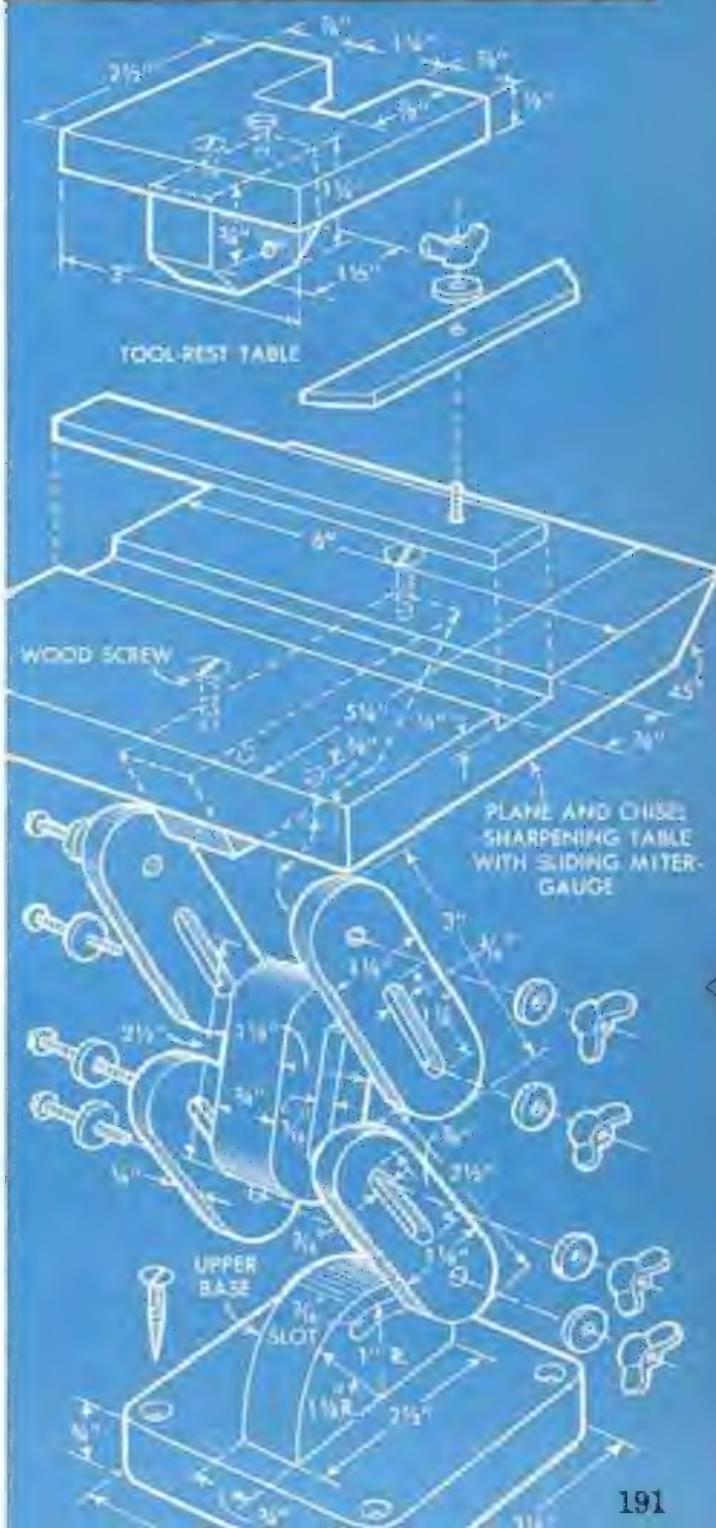


Re-S.N.'55

Tool Rest for Your BENCH GRINDER

By Robt. C. Barnes

TAKING THE GUESSWORK out of free-hand grinding comes easy with this all-purpose tool rest. It's designed and dimensioned for use with a grinder-polisher unit of the type that is bolted to the bench top and belt-driven from the rear or from below with a small motor. Two tool rests are detailed, one of which is notched to fit around the grinding-wheel rim to provide support for side grinding. The other is grooved for an adjustable sliding gauge, or guide. Both the tool rest and table are adjustable by means of a parallel-arm assembly to give any common edge bevel when grinding tools. The table and tool rest also are adjustable up and down and in and out in relation to the wheel rim and can be locked securely in the desired position by means of wing nuts. The base on which these parts are mounted consists of two members, an upper and lower, the latter being a square block of hardwood to which the upper member is attached with screws and glue. The upper member is semicircular and is slotted on a 1-in. radius to permit adjustment of the $\frac{1}{4}$ -in. stove bolt which holds the lower ends of the first pair of parallel arms. Note that the parallel arms are slotted as is the center member, or spacer. The slots facilitate easy adjustment. All parts detailed should be cut from hardwood. When mounting the unit on the bench top, care must be taken to position it square with the grinding wheel. Always wear goggles when grinding with an unguarded wheel like that shown.



Improvised Spindle Sander Driven by Flexible Shaft



An efficient spindle sander for edge-sanding irregular work can be improvised from a flexible shaft, a table and a small sanding drum. First, bore a hole in the center of the table top just large enough to admit the drum. Then cut a 4 x 6-in. block from 1½-in. hardwood, and a triangular brace from 1-in. stock. After screwing these together, glue a 4 x 5-in. piece of ½-in. stock to the block in order to shim out the shaft handle far enough to permit clearance for the chuck. Then drill-slot the block as shown in the detail. Attach the flexible shaft to the block assembly by means of J-bolts and wing nuts and tighten the sanding drum in the chuck. Insert the drum through the hole in the table and fasten the block brace to the table with screws countersunk in the table top.

Horn Wire Kept From Shorting Against Steering Shaft

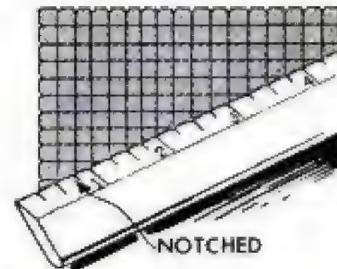
On cars having the horn-button wire inside the steering-shaft housing, the insulation sometimes becomes worn just inside the opening through which the wire enters, allowing the latter to short against the steering shaft. To avoid replacing the wire, disconnect it at the horn and slide a piece of cambric tubing, such as is used in radio repair, over the wire to cover the defective portion and also to protect the insulation at the opening. A piece of stiff wire having a hook formed on the end will be needed to snake the horn wire through the soft material. The projecting end of the tubing is then taped in place. Another method is to use a nonmetallic loom, which is available at most electrical-supply stores, in place of

the cambric tubing. This can be slipped easily over the end of the horn wire and will not require taping.

Paul B. Duryea, San Francisco, Calif.

Method of Cross-Ruling Paper

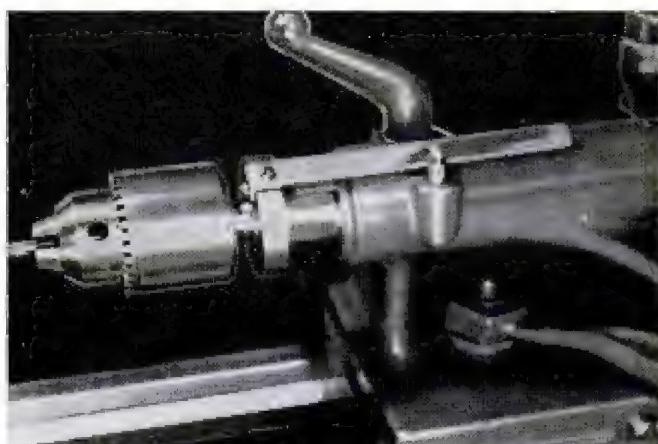
It often is possible to save time when ruling lines to form squares on paper, as in a graph, by notching the edge of a wooden ruler at whatever intervals are desired. Then, using the ruler, draw lines at right angles to each other at the top and side of the sheet. It then is a simple matter, after squaring the sheet on a drawing board, to use a T-square for cross-ruling, moving it from one indented point to another. For ruling the vertical lines when the sheet is too large to rule with the triangle without shifting the T-square, simply turn the sheet, again square it and tack or tape it in place.



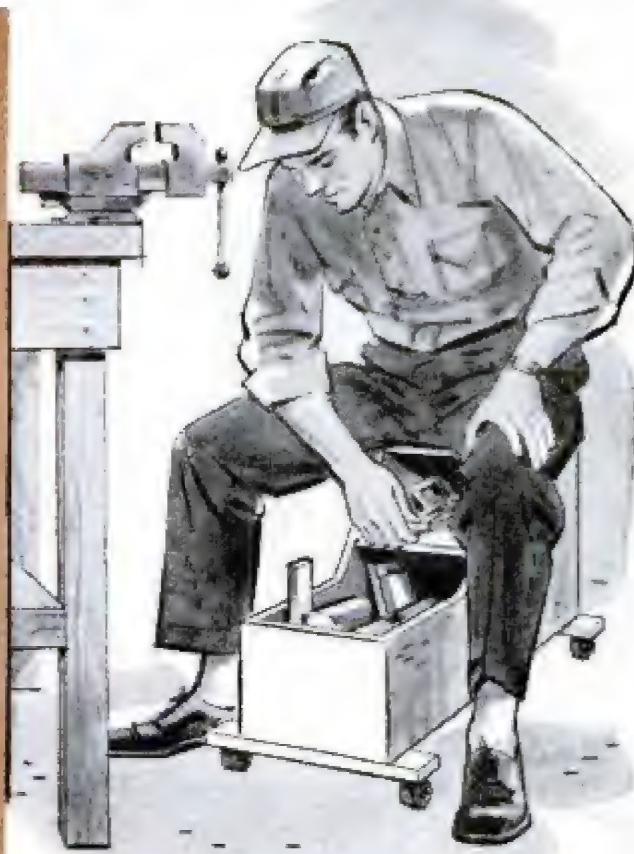
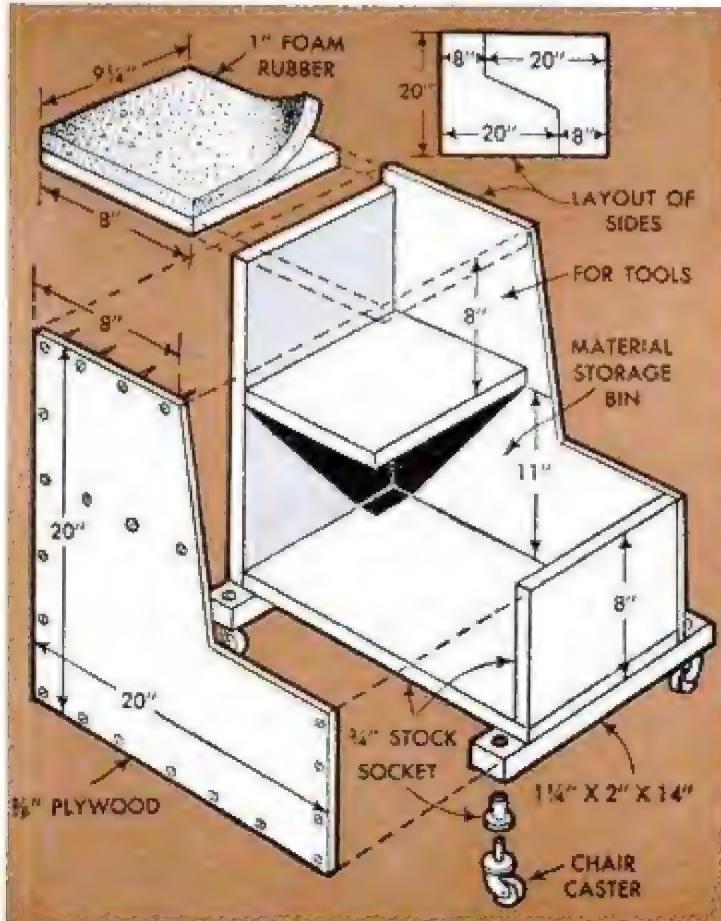
Depth Indicator Attached to Lathe For Drilling Operations

Duplicate drilling operations on a lathe can be faster and more accurate with the addition of this simple depth indicator. A collar $\frac{5}{16}$ in. wide, having an outside diameter greater than the casting, and an inside diameter of a size to fit snugly over the ram, is mounted on the front edge of the tailstock ram and secured by a setscrew. A flat-steel strap projects back over the tailstock casting and is fastened with screws tapped into the collar. This strap is polished to provide a "tooth" for pencil marks. A pointer, in this case wedged into the oil well, serves as the indicator. In use, a "zero" mark is established under the pointer with the drill at the surface of the work, and then the desired depth is measured and marked on the strap.

H. K. Chapman, Englewood, Colo.



Rolling Shop Stool Features Storage Space



A stool that incorporates storage space is doubly useful around the shop, and this one has the added feature of being on casters to allow the craftsman to push himself from one end of the bench to the other. Providing a comfortable padded seat at convenient bench height, the stool also will be

found handy for many jobs away from the bench where both tools and materials can be kept together. Plywood is ideal for the sides of the stool with solid stock being used for the rest of the parts. Both side members of the stool can be laid out without waste from a 20 x 28-in. panel of plywood.

Automatic Shutoff for Pump Provided by Extension Cord

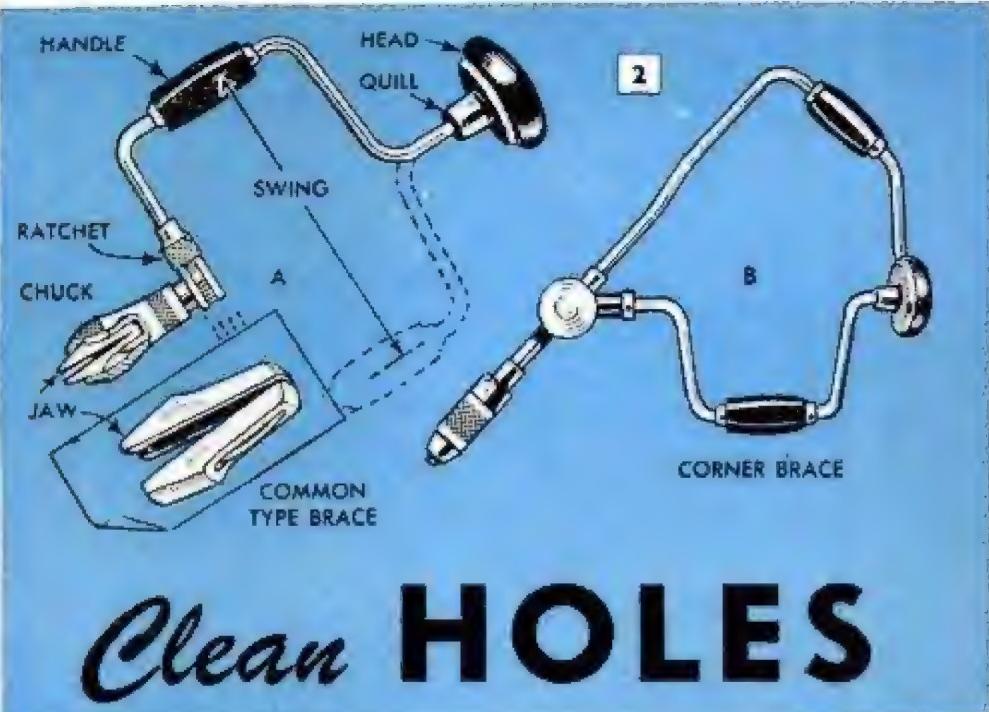


An electric extension cord provides one farmer with an automatic shutoff for a 1-cyl. gasoline engine used to operate a pump jack when filling a water tank. This is done by removing the socket and attaching one wire to the spark plug. The other is grounded on the engine. The plug end of the cord is then suspended as shown from the rim of the tank at the water level desired. When the water reaches the prongs of the extension-cord plug, the spark plug is grounded, thus stopping the engine and halting the pumping operation.

A. M. Wettach, Mt. Pleasant, Iowa.

Carrying Tacks Safely in Pocket

To avoid injuring his hand on tacks carried loosely in his pockets, one billposter presses the tacks into a small piece of insulation board which fits a pocket. Several pieces of corrugated cardboard can be taped together to serve the same purpose.



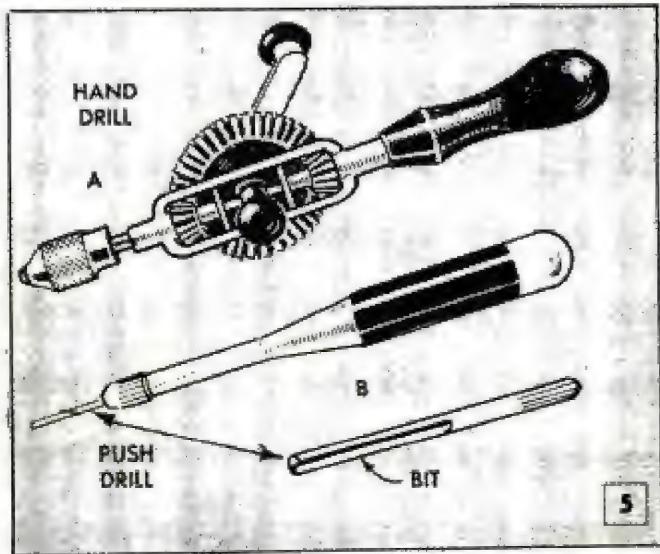
Clean HOLES

Tricks in boring holes in wood—what you need to know to handle a brace and bit like a professional

By E. R. Haan

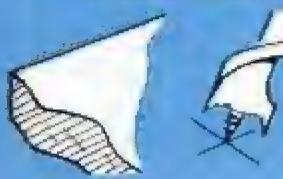
BORING CLEAN, TRUE HOLES in wood with a hand brace and auger bit calls for a certain amount of manual skill which is easily acquired when you know the correct procedures. In common practice, holes from $\frac{1}{4}$ to 3-in. diameter can be bored in both hard and soft woods to the precise diameters and depths required by the work. Ordinary bit sizes run from $\frac{1}{4}$ to 1 in. inclusive. Above 1 in., special types, including the expansive bit, are regularly used.

Auger-bit braces: Wood-boring augers, also called auger bits, are held in a brace as shown in Figs. 1 and 2 and detail A, Fig. 6. Turning the chuck sleeve opens and closes two jaws which grip the square, tapered tang of the auger. Universal chucks are designed to grip both augers and round-shank drills. A ratchet-type brace that permits turning the bit in either direction with short strokes is often necessary in cramped quarters. A corner brace, detail B, Fig. 1, permits a full sweep of the handle in corners





HOLDING BRACE FOR HORIZONTAL BORING



PRESS SCREW POINT
INTO WOOD AT MARK

in WOOD

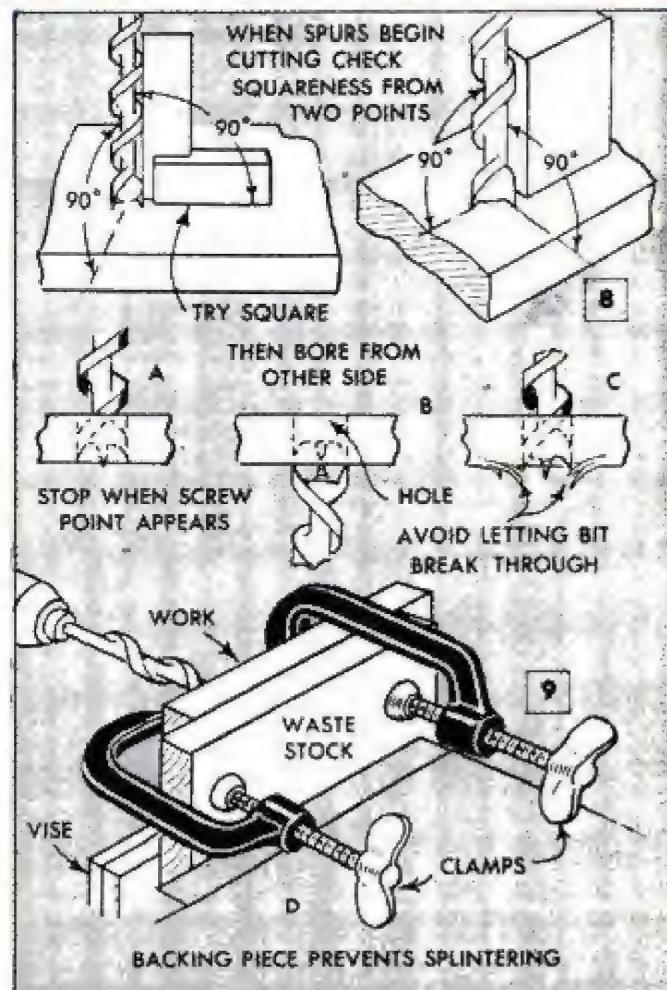
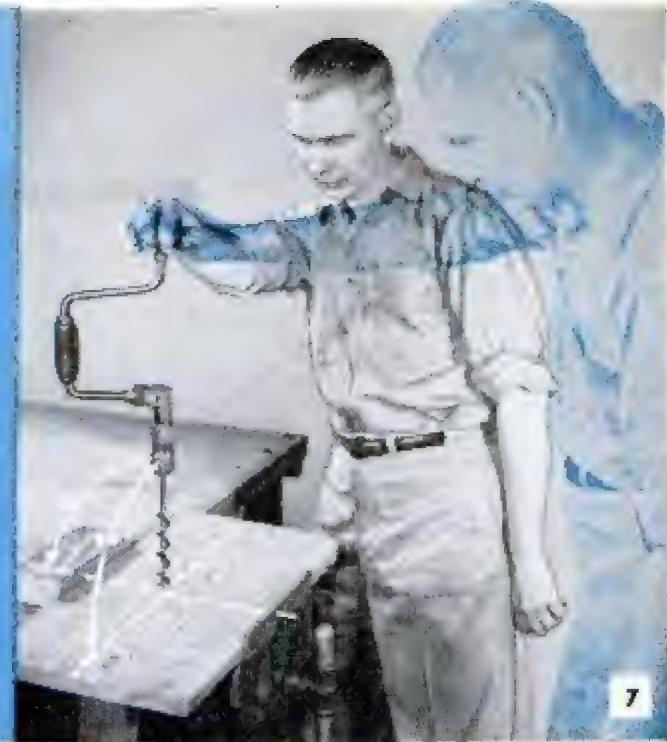
where this is impossible with a ratchet brace due to lack of clearance.

To insert a bit in the chuck you hold the latter with the left hand while swinging the handle with the right arm as in Fig. 3. Insert the bit as in Fig. 4 so the tang fits between the jaws centrally, then tighten the chuck.

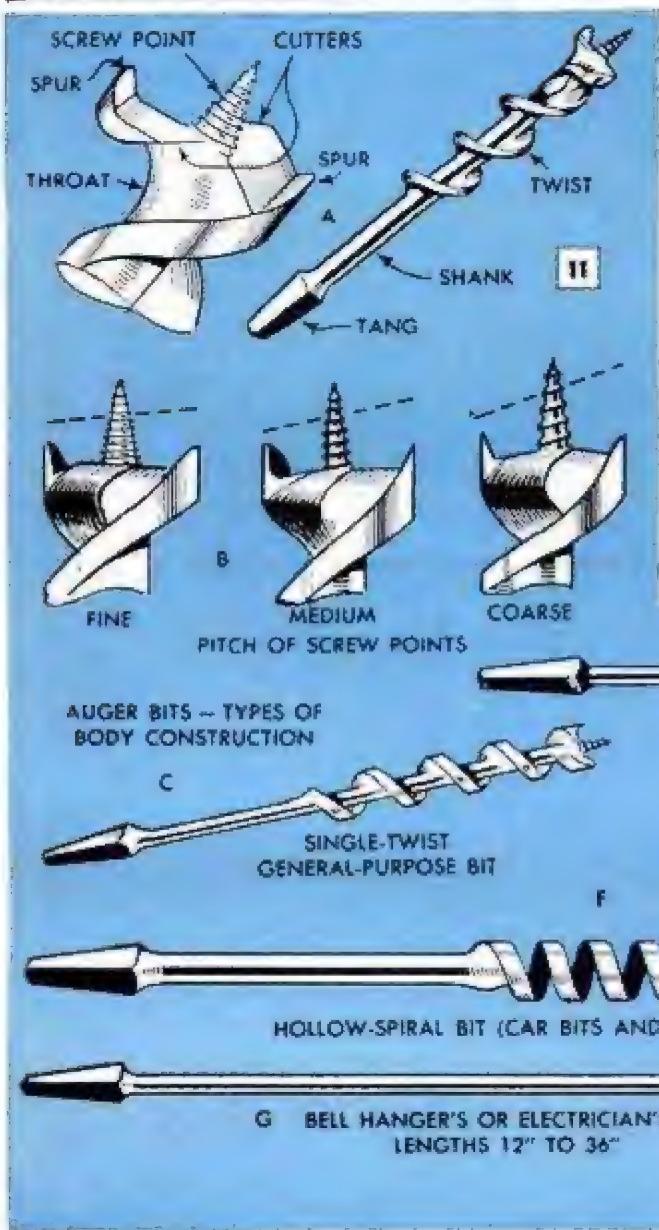
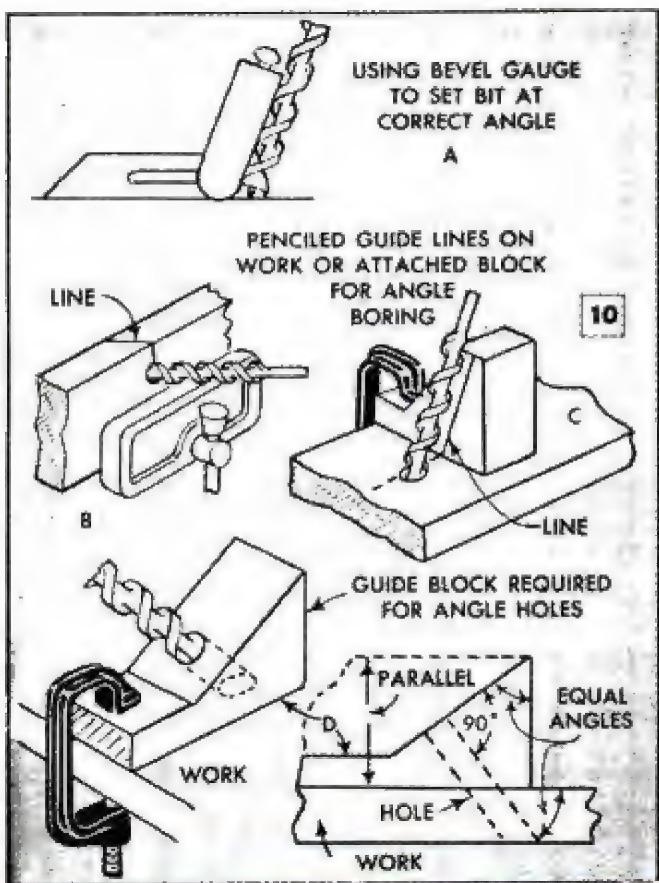
Hand and push drills: Hand drills, detail A, Fig. 5, are used to drive twist drills, countersinks and reamers having round shanks. Most small hand drills take twist drill bits up to $\frac{1}{4}$ in. Some hand drills have a control to vary the gear ratio and may also be fitted with a ratchet.

Automatic push drills, detail B, Fig. 5, differ from hand drills in that you merely push the handle, which applies the required pressure and causes the drill point to rotate. They drill small holes quickly and are handy to have in any homeowner's tool kit. A set of special bits from $\frac{1}{16}$ to $1\frac{1}{64}$ -in. dia. usually is included, the handle of the tool being designed to provide storage for the extra bits.

Boring and drilling procedures: Work to be bored or drilled should be supported rigidly so that you can hold the brace or drill either vertically or horizontally as in Fig. 1 and detail A, Fig. 6. After marking the exact location of the hole center, press the screw point of the bit into the wood, detail B, Fig. 6, to start it accurately. To start twist or push drills, punch a starting hole with a scratch awl. A bit must be held at right angles to the surface of work unless the hole is to be bored at an angle. Check this when the spurs first score the wood, detail A, Fig. 11. You can sight from two points at right angles to each other as indicated in Fig. 7, although the methods shown in Fig. 8 give more accurate results.



Recheck the bit position after the spurs have entered the wood. It is then still possible to shift the bit position. Don't attempt to change the course of a bit after it has fully entered the wood as this often results in bending it. Continue boring until the screw point breaks through on the opposite side of the work, detail A, Fig. 8. Don't permit the spurs to cut through, detail C, as the wood may splinter and spoil the work. When the screw point can be seen or felt,

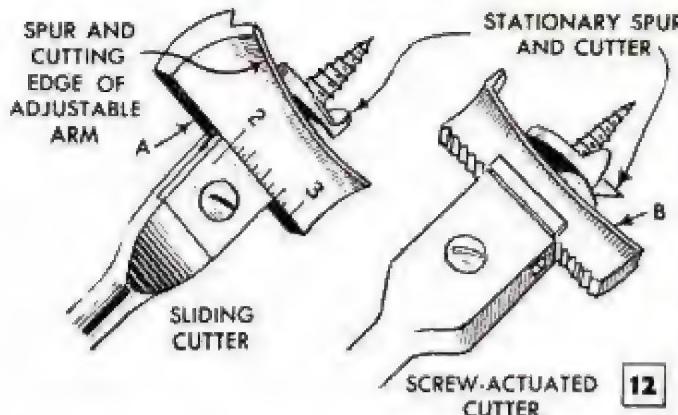


stop boring and withdraw the bit carefully. Reverse the work and finish the hole from the other side, detail B. Another way to prevent splintering the edges of a hole is to back up the work with a flat piece of waste wood as in Fig. 9.

As twist and push drills penetrate rapidly, the flutes often become clogged with chips, particularly in resinous wood. To clear the drill of chips, remove it several times as drilling progresses.

Boring at an angle: To bore at a slight angle from the perpendicular, use a bevel gauge as a guide in starting, detail A, Fig. 10. Another method is by sighting over a line marked on the edge of the work, detail B, or on a block clamped to the work, detail C. To bore a hole at an angle greater than 30 deg. from the perpendicular, use a hardwood guide block clamped to the work, detail D. The hole in the guide block must be the same size as the one to be bored. Cut the block to the shape indicated with the top edge at the correct angle. Then bore the hole in the block perpendicular to the top edge. Locate the block so that this hole will center over the mark on the stock.

Wood-boring auger bits: Although common augers or bits for wood usually range from $\frac{1}{4}$ to 1-in. dia., they are obtainable in sizes ranging from $\frac{1}{16}$ to 2 in. The sizes are in $\frac{1}{16}$ -in. steps. The number on the shank indicates the size in 16ths of an inch. Thus a No. 12 bit is $\frac{1}{16}$ or $\frac{3}{4}$ in. in diameter. Fig. 11, detail A, shows a typical bit. The screw point pulls the bit through the wood; the spurs cut the sides of the hole and the cutters remove the waste. Screw points are supplied in fine, medium and coarse pitch, detail B, Fig. 11, so they will advance the bit at a slow, medium or fast rate. A medium-pitch screw point gives the best results on average work. For boring into end grain and in resinous, green or wet wood, a coarse screw point is best and also is least likely

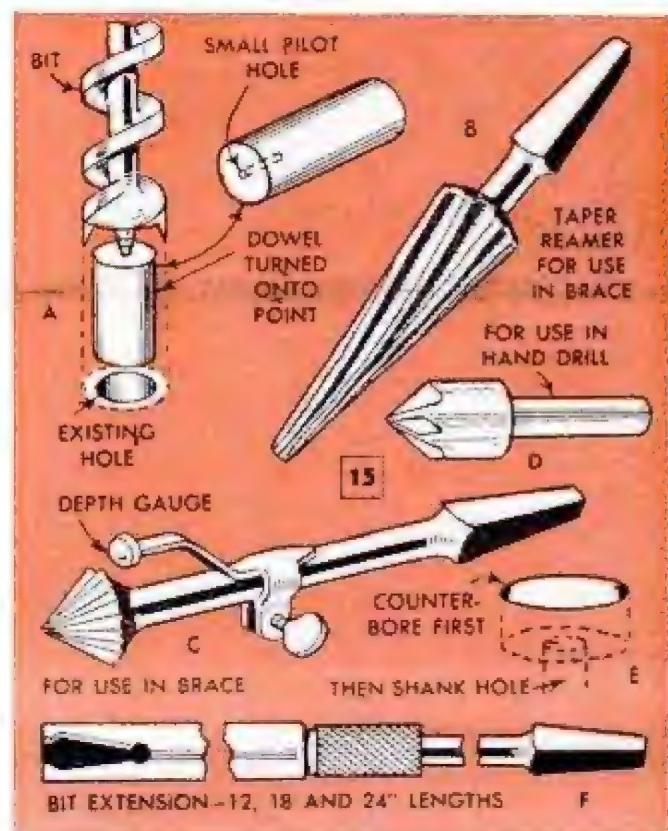
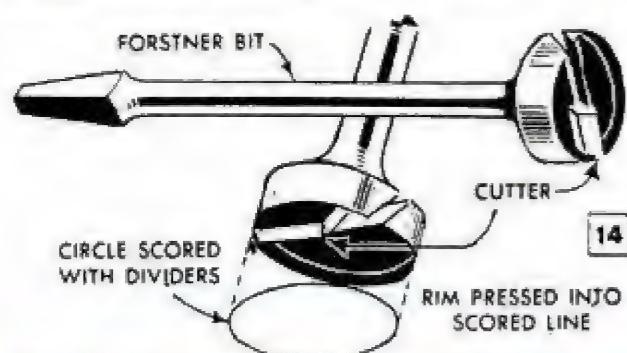


to clog. A slow-feeding point reduces effort in boring close-grained hardwood as the cutters slice off thin chips. A slow feed on a sharp bit produces clean holes. When a sharp bit having a screw point of the correct pitch is used, practically no pressure on the brace is required. Pressure becomes necessary when the point clogs and strips off wood. Stripping of wood by the screw point usually is caused by dull cutters.

Auger bits vary in body construction as shown in details C to E inclusive, Fig. 11. The single-twist solid-center type, detail C, is the most common. It bores fast, is suitable for hard and resinous woods and clears itself of chips readily. Double-twist bits, detail D, are used by cabinetmakers for exacting work; they bore smoother and more accurate holes. The type of auger shown in detail E is of comparatively recent development and comes in sizes of $\frac{3}{8}$ to 1 in. These augers have no body twist, but the working end has the conventional screw point, and spurs and cutters are formed on short, flat "wings." Detail F shows a hollow spiral auger available in lengths from 10 to 20 in. Car bits and ship augers are of this type and they are available with and without both spurs and screw points.

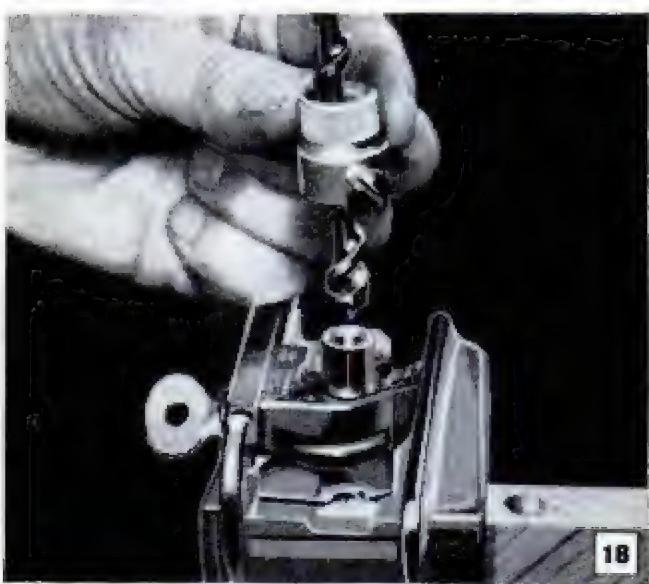
Twist drills: Twist drills that have a square, tapered tang, detail H, Fig. 11, are used in a brace for drilling in wood. They can be obtained in sets, the sizes ranging from $\frac{1}{16}$ to $\frac{3}{8}$ in. Larger sizes up to 1 in. also are available. There are two kinds, one for wood only, the other for both wood and metal. Since twist drills have no screw point they require some pressure to penetrate stock. Bell-hanger's or electrician's bits, detail G, are useful for drilling through floors and in walls or partitions.

Expansive bits: As an expansive bit can be adjusted to bore holes of different diameters, one takes the place of many separate bits. The expansive bits, Figs. 12 and 13, come in two sizes, each including two interchangeable cutters. One size has a range from about $\frac{1}{2}$ to $1\frac{1}{2}$ in., and the other from $\frac{3}{8}$ to 3 in. For some makes, extra cutters that increase the capacity to 5 in. are available. Fig. 12, detail A, shows an expansive

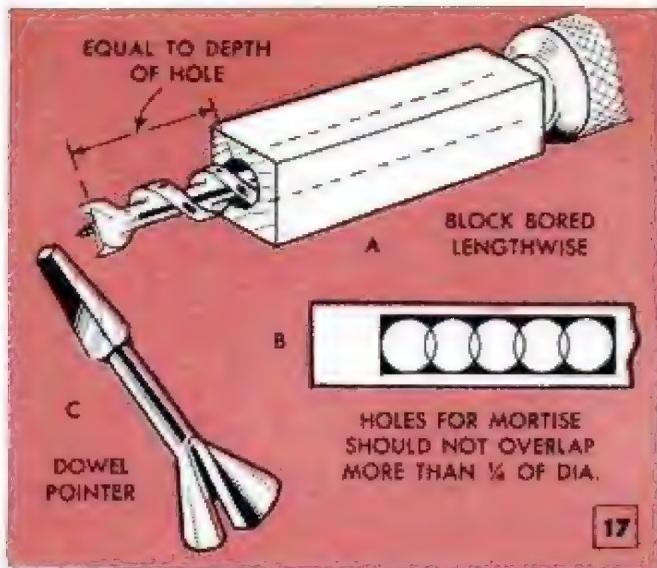




16



18



17

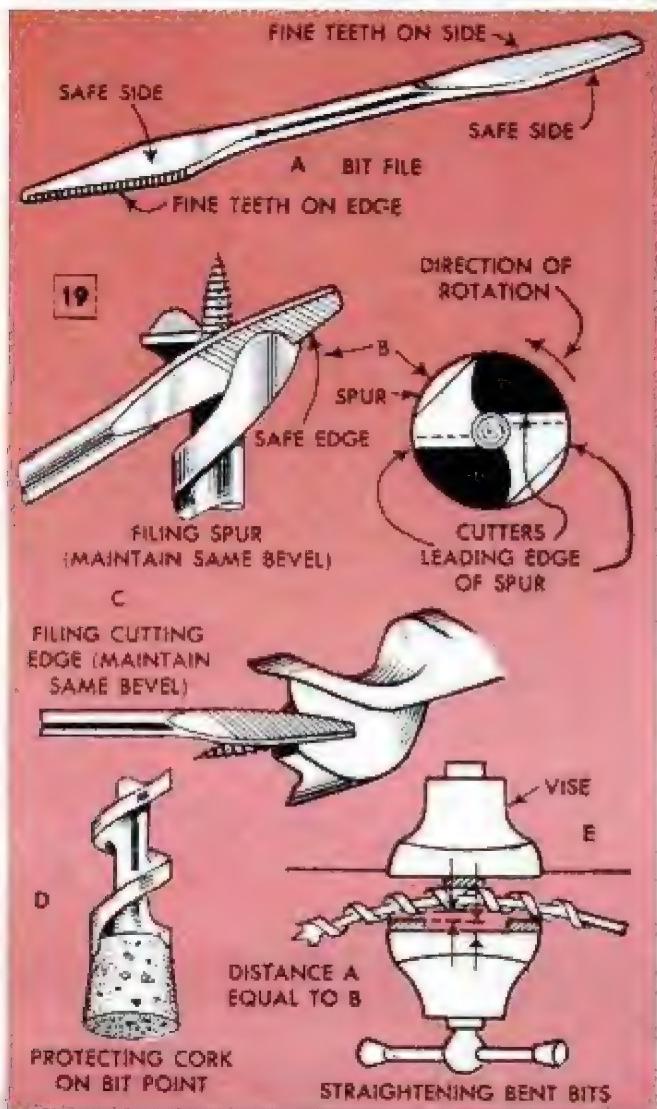
bit having a sliding cutter; detail B shows one where the cutter is moved or held in position by means of a cross-feed screw. Advancing the cutter $\frac{1}{32}$ in. increases the hole diameter $\frac{1}{16}$ in. The cutter should not be set beyond the indicated range. After adjusting it, always check for correct results by boring into a piece of waste wood. When using an expansive bit, clamp a piece of flat waste stock securely to the back and bore through the work into it.

Forstner bits: Having no screw point or spurs, Forstner bits, Fig. 14, are handy for drilling blind holes without breaking through the back surface of the work with a screw point or spurs. They also are used for boring into end grain, and for cutting very thin stock, especially near edges where an ordinary bit might split the wood. Where accurate locating of the hole is necessary, start a Forstner bit by scoring a circle the exact size of the bit to be used with a pair of dividers. Then press the sharp rim of the bit into the score.

Accessories for hand boring: An ordinary auger can be used to enlarge an existing round hole. A short length of dowel having the same diameter as the hole is turned onto the screw point, detail A, Fig. 15. A pilot hole drilled in the exact center of the dowel is usually necessary to prevent it from splitting. The dowel should fit the hole snugly, yet should turn freely.

Existing holes also can be enlarged with reamers. A tapered reamer is shown in detail B. This tool is well suited for enlarging holes in thin stock, but less suited to enlarging holes in thick stock where a uniform diameter is required. However, if one must be used for this purpose, ream both ends of the hole to the desired diameter, then enlarge the center portion with a round file.

To ream the ends of holes to take flat-headed screws, use a countersink, details C and D, Fig. 15. Where a number of holes



must be countersunk to exact depth, use a stop, or gauge, detail C. In counterboring to take the heads of bolts or screws, counterbore first, then bore or drill the shank hole, detail E. For deep holes a bit extension, detail F, often is used, although limited to bits of certain diameters. For boring small holes through walls and floors use an electrician's bit, car bit or ship auger. To bore to a predetermined depth, clamp a depth gauge to the bit, Fig. 16, or use a block of wood, detail A, Fig. 17. Holes for mortises can overlap up to $\frac{1}{4}$ of their diameter, detail B. Matching holes for dowel joints are bored accurately with the aid of a doweling jig, Fig. 18. Score center lines for the holes on both mating pieces, using a try square. Then adjust the jig for width and clamp it onto the stock with the index mark lining up with the scored center lines. Use the right size bit guide in the jig and adjust the depth stop, which is clamped onto the bit. For chamfering the ends of dowels to enter holes easily, use a dowel sharpener, detail C, Fig. 17.

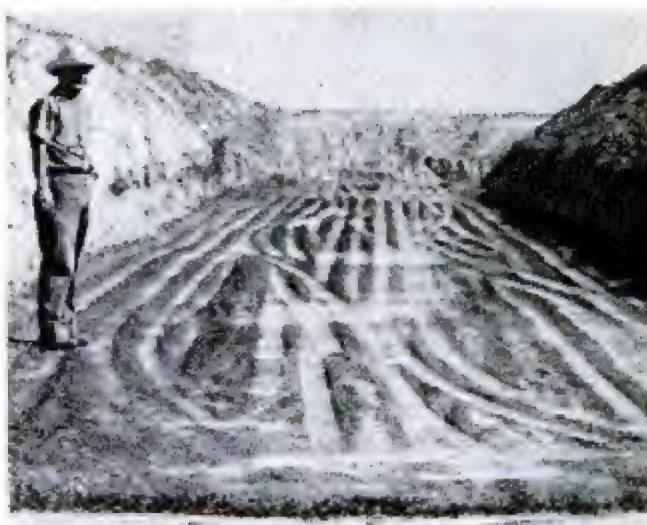
Sharpening bits: Sharpening wood-boring bits is a simple job as shown in Fig. 19, details B and C. It is done with a special bit file, detail A, Fig. 19, which has "safe" edges and sides. File the spurs from the inside, detail B, removing an equal amount of metal from each edge. Maintain the original bevel, keep the spurs equally high and don't reduce the thickness at their bases. Never file spurs on the outside. Remove any burr with an oilstone. When you file the cutters, hold the bit point on the bench as in detail C.

Bit care: Keep bits not in use protected with a cork, a length of dowel or a plastic bit cap screwed onto the point, detail D, Fig. 19. Wipe bits with an oily rag after use to prevent rust. Bent bits, detail E, Fig. 19, can be straightened by carefully following the method shown. ★ ★ ★

Metal Bent Without Breaking

For best results when bending steel rod at sharp angles, first heat it with a blowtorch on one side only and then bend it toward its hottest side. By applying heat in this manner, the metal has a tendency to "pivot" on the cooler side, causing the metal on the inside of the bend to be upset, or crowded together. This will thicken the rod slightly at the bend, but this will serve to reinforce the metal rather than weaken it, as is the usual result of improper heating and bending. This occurs when the rod is bent away from the hottest side, or when it has been heated uniformly all around, which in either case will cause the metal to "neck"—stretch thin—fracture or break off completely.—Andrew Vena, Philadelphia, Pa.

Asphalt and Oyster Shell Mixed To "Pave" Long Trench Silos

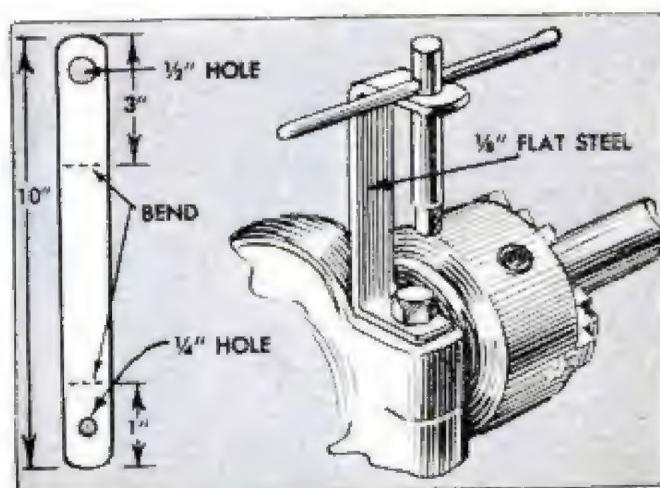


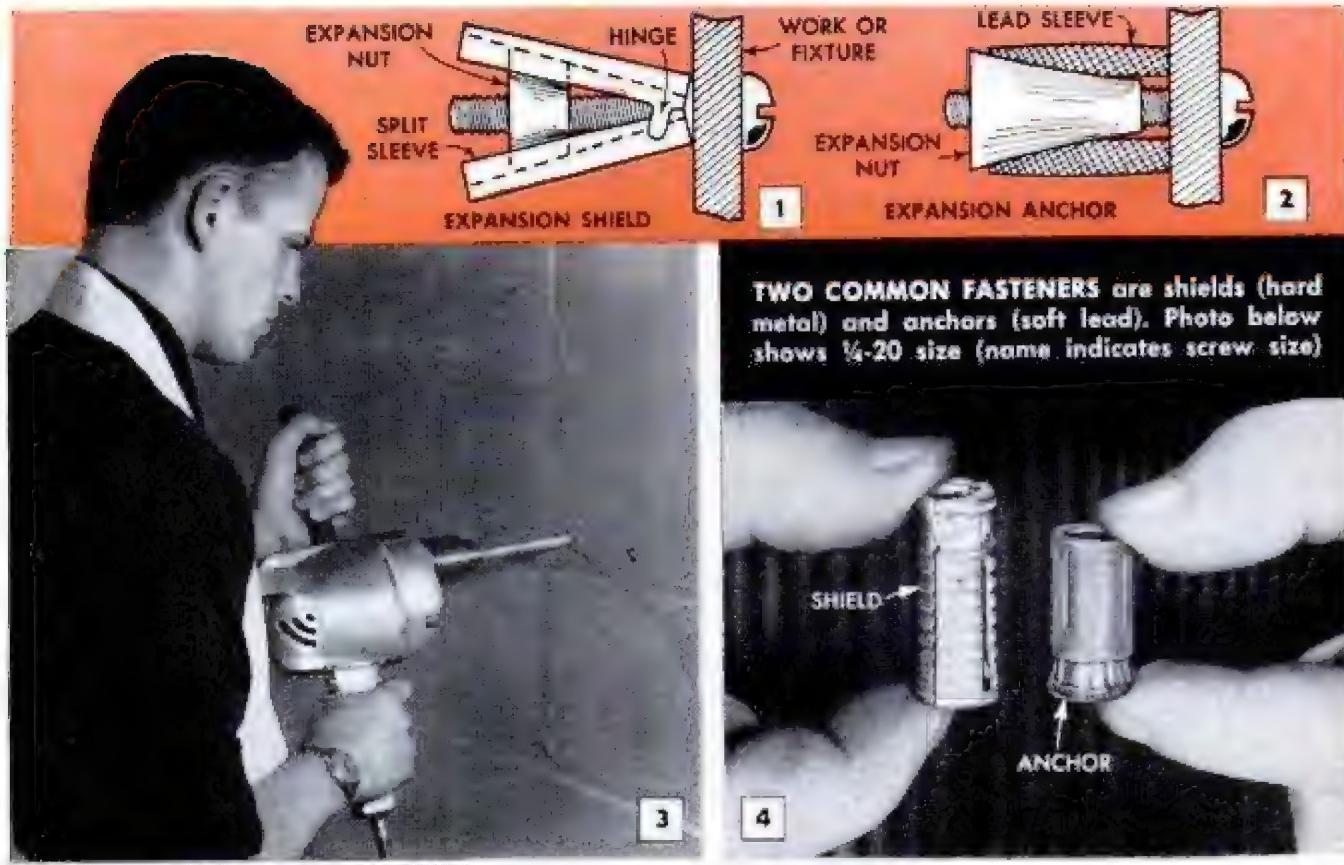
Many Gulf Coast stockmen and others who employ the trench-type silo for storage, are finding that a mixture of asphalt and crushed oyster shell makes a firm yet flexible floor and ramp for trench silos, allowing the heaviest farm equipment to haul out the silage without bogging down in mud. After the mixture is hauled to the farms, it is spread with a tractor dozer and then pressed with a roller made from 55-gal. drums filled with concrete. A 4-in.-thick layer of the mixture is strong enough to support the average load without cracking. The smooth surface makes it easy to handle silage with a tractor scoop.

Bob Gray, Houston, Tex.

Holder on Lathe Headstock Keeps Chuck Key Handy

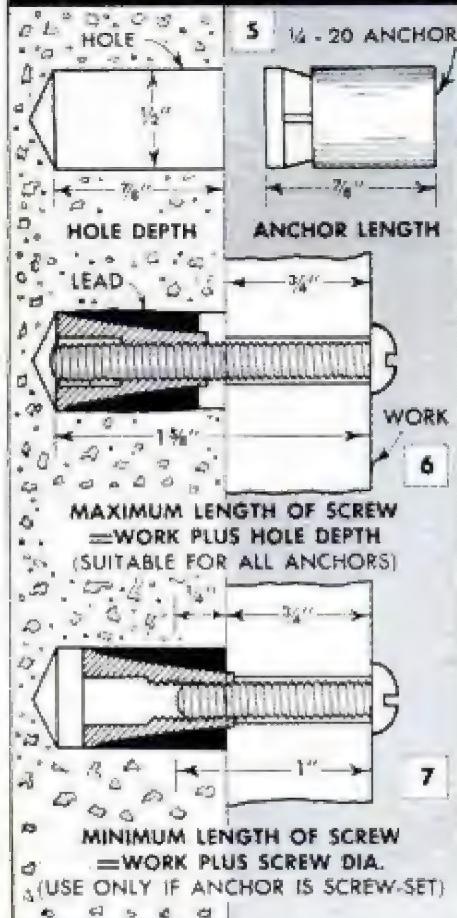
To keep the chuck key for his lathe within easy reach and also to prevent its loss when not in use, one machinist improvised a holder for it which he bolted to one of the lathe-headstock bearings. A piece of flat steel, measuring $\frac{1}{8} \times 1 \times 10$ in., was drilled and then bent to a U-shape, after which it was mounted as shown.





TWO COMMON FASTENERS are shields (hard metal) and anchors (soft lead). Photo below shows $\frac{1}{4}$ -20 size (name indicates screw size)

DRILLING HOLES is easy with carbide drills. Drills up to $\frac{1}{2}$ -in. dia. are available with $\frac{1}{4}$ -in. shanks for small drill



BOLTS AND SCREWS are not usually sold with shields or anchors but are purchased separately in styles and lengths to suit purpose



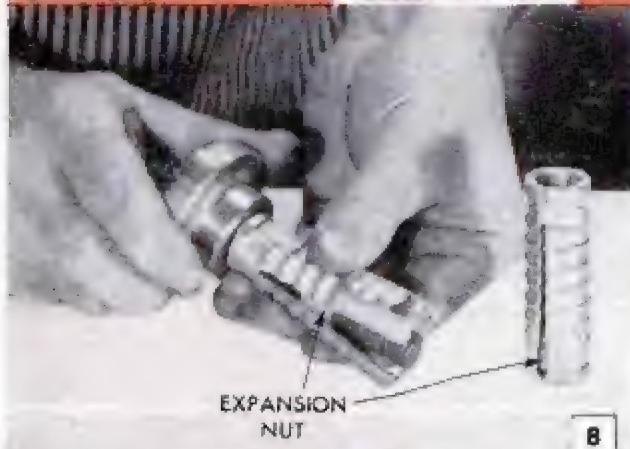
ANCHORS *in Concrete*

By Sam Brown

THERE'S NO NEED to put off that job of hanging a shelf on the concrete wall in the basement. Using a carbide-tipped drill and masonry anchors you can have it up in a jiffy. It will be just as firm and secure as a shelf attached to plaster or wood with brackets and screws, and it will support an equal weight.

Shields and anchors: Shields are made of hard metal, usually rustproofed malleable iron while anchors are made of soft metal, usually lead. Both work on the same general principle—a wedge nut or cone expands the outer sleeve as shown (exaggerated) in Figs. 1 and 2. Shields are the easiest to install and are the strongest; anchors are inexpensive and hold tightly in relatively shallow holes. The smallest shield is the $\frac{1}{4}$ -20 size, which means it takes a machine screw or bolt $\frac{1}{4}$ in. in diameter and having 20 threads to the inch. Anchors are available in a wide range of sizes, starting at 6-32, which is about $\frac{1}{8}$ in. in diameter, Fig. 16. As can be noted in the table, the over-all diameter of the anchor averages double the diameter of the name or screw size. This applies likewise to shields. Shields are about half again as long as anchors, as can be seen in the typical example, Fig. 4,



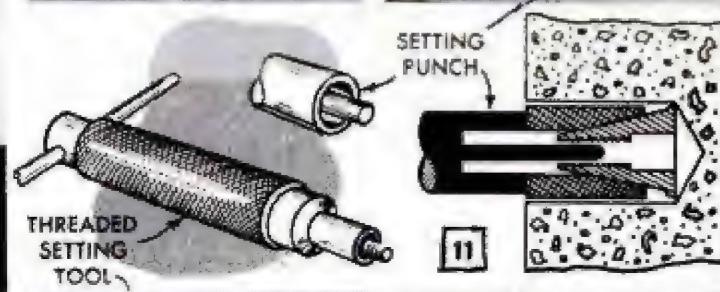


SHIELD IS EXPANDED by the screw when it is turned into place. Builders often use handled screw to preset shield when required

picturing the popular $\frac{1}{4}$ -20 size shield.

Bolts and machine screws used: When you buy shields or anchors, bolts or machine screws are purchased separately to suit. Note in Fig. 5 that the anchor or shield always sets its own depth in the hole. Hence, the maximum length of the screw is equal to the length of the anchor plus thickness of the work or fixture, Fig. 6. Shields always take the maximum length because the expansion nut is at the bottom of the shield, as can be seen in Fig. 8. Very short screws can be used with machine-screw expansion anchors under certain conditions, Fig. 7. The safe specification for all devices is the next stock length under maximum. Another safe specification is the use of stove bolts, either the flat or round-headed type.

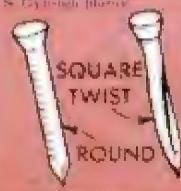
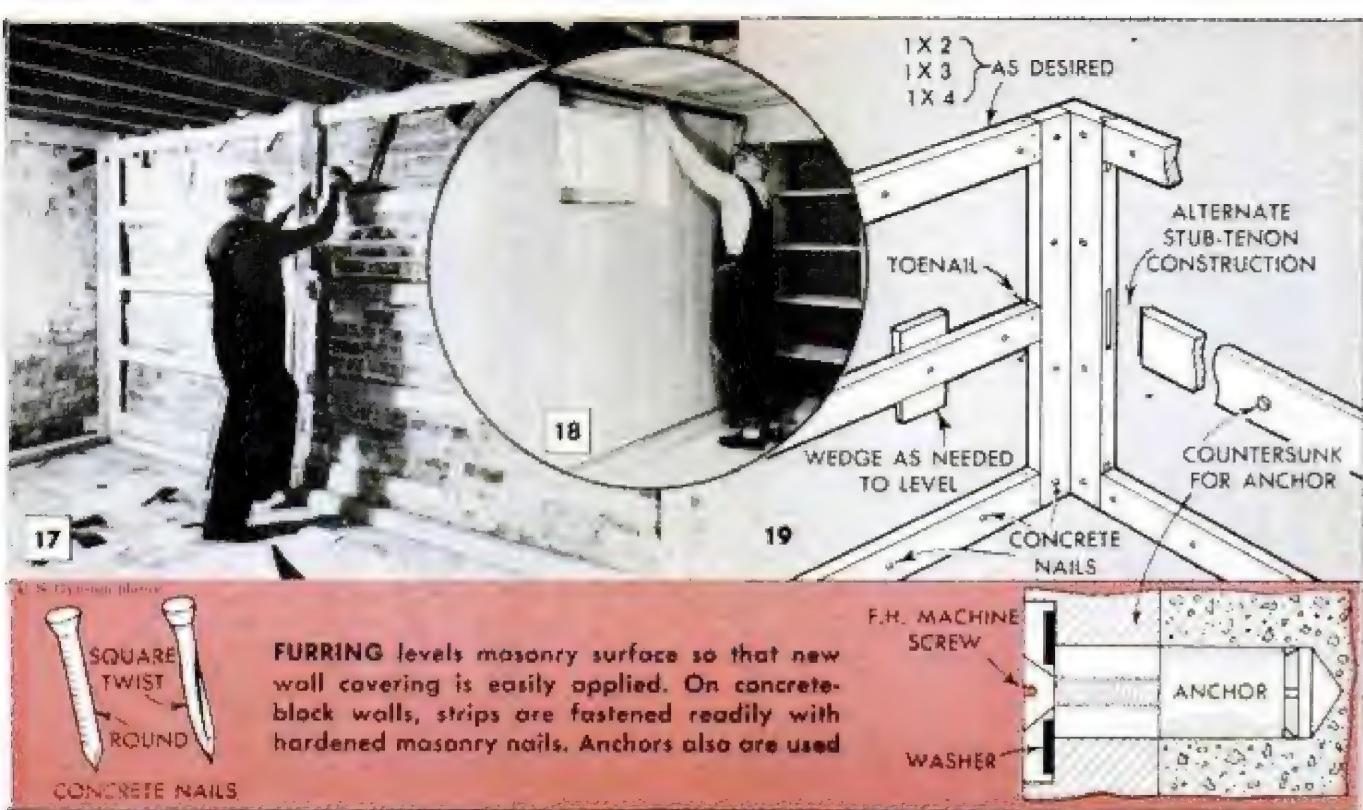
Installing shields: To install shields, insert in the hole, put the fixture in



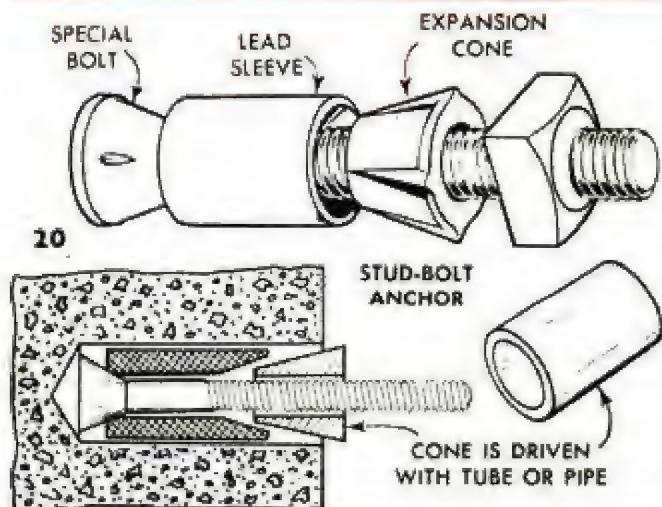
ANCHORS ARE SET either by hammering or by screw action. Hammer setting is most practical and is done easily with tube or punch which fits anchor

| | | STOCK SIZES - MACHINE SCREW EXPANSION ANCHORS | | | | | | | | | | | |
|---|------------------|---|----------------|----------------|----------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|--------------------|--|
| | | .138 | .164 | .190 | .216 | .250 | .312 | .375 | .437 | .500 | .625 | .750 | |
| DIA. OF SCREW | SCREW | 6-32 | 8-32 | 10-24 | 12-24 | $\frac{1}{4}$ - 20 | $\frac{5}{16}$ - 18 | $\frac{3}{8}$ - 16 | $\frac{7}{16}$ - 14 | $\frac{1}{2}$ - 13 | $\frac{9}{16}$ - 11 | $\frac{5}{8}$ - 10 | |
| D* | DIAMETER OF HOLE | $\frac{1}{4}$ | $\frac{5}{16}$ | $\frac{3}{8}$ | $\frac{7}{16}$ | $\frac{1}{2}$ | $\frac{5}{8}$ | $\frac{3}{4}$ | $\frac{7}{8}$ | $\frac{1}{2}$ | $1\frac{1}{2}$ | $1\frac{1}{4}$ | |
| L* | DEPTH OF HOLE | $\frac{3}{8}$ | $\frac{1}{2}$ | $\frac{5}{8}$ | $\frac{3}{4}$ | $\frac{7}{8}$ | 1 | $1\frac{1}{4}$ | $1\frac{1}{2}$ | $1\frac{1}{4}$ | $1\frac{1}{2}$ | 2 | |
| SCREW LENGTH FOR $\frac{3}{4}$ " WORK | MIN. | 1 | 1 | 1 | 1 | 1 | $1\frac{1}{4}$ | $1\frac{1}{4}$ | $1\frac{1}{4}$ | $1\frac{1}{4}$ | $1\frac{1}{2}$ | $1\frac{1}{4}$ | |
| | BEST | 1 | 1 | $1\frac{1}{4}$ | $1\frac{1}{4}$ | $1\frac{1}{4}$ | $1\frac{1}{2}$ | $1\frac{1}{2}$ | 2 | 2 | 2 | $2\frac{1}{2}$ | |
| | MAX. | $1\frac{1}{2}$ | $1\frac{1}{4}$ | $1\frac{3}{4}$ | $1\frac{1}{2}$ | $1\frac{1}{2}$ | $1\frac{1}{4}$ | 2 | $2\frac{1}{4}$ | $2\frac{1}{4}$ | $2\frac{1}{2}$ | 3 | |
| SAFE LOAD (lbs. in concrete) | | 80 | 100 | 150 | 175 | 200 | 300 | 450 | 600 | 800 | 1000 | 1300 | |

* Manufacturers have no standard. Figures are for a representative product and are fairly uniform for all brands. All threads are National Coarse (U. S. Standard) as listed at top of box



FURRING levels masonry surface so that new wall covering is easily applied. On concrete-block walls, strips are fastened readily with hardened masonry nails. Anchors also are used



BOLT HEAD IN HOLE is required for some jobs. Here a stud-bolt anchor is used. It is set by means of pipe driver or special anchor tool

place and then tighten the screw or bolt. Fig. 8 shows how the action of the screw expands the shield. Of course, in the detail drawing the spread of the shield is exaggerated. Actually, the shield expands very little in a close-fitting hole. The extreme wedging action is useful when fitting shields in oversize holes; and also provides a firm anchorage when the shield is fitted through thin material, such as $\frac{3}{8}$ -in. plasterboard. A handled screw, Fig. 8, is often used to preset the shield in the hole, after which the screw can be removed. Shields can be removed readily by driving the expansion nut backward with a punch.

How to install anchors: Anchors are probably more popular than shields because they are available in smaller sizes. They are just as easy to install as shields,

but do not hold as securely in an oversize hole. For this reason care must be taken to drill the hole to the correct size, Fig. 3. A trick in drilling a hole in concrete precisely $\frac{1}{2}$ in. in diameter for a $\frac{1}{4}$ -20 anchor is to use a $\frac{5}{16}$ -in. masonry drill. You will find that carbide masonry drills are made a little oversize, and this, plus the natural tendency of the drill to wander somewhat will result in a hole $\frac{1}{2}$ in. in diameter. Brick drills cleaner and can take the $\frac{1}{2}$ -in. drill bit direct. The required depth of hole is obtained by wrapping a piece of adhesive tape around the drill bit to act as a depth stop. With the hole drilled, put the anchor in place, Fig. 9, and then set with several light hammer blows against the setting punch, Figs. 10 and 11. Lacking a punch, you can set the anchor with a piece of $\frac{1}{2}$ -in.-outside-diameter tubing. The only difference is that the special punch has a pilot in the center to provide easy and accurate location, Fig. 11. Anchors also can be hammer-set with any kind of punch, or a screwdriver in an emergency.

Anchors also can be preset completely by means of a screw. This method of installation is necessary in through holes or in blind holes with weak bottoms which would not withstand hammering. The best device for screw-setting is the special tool shown in Fig. 11. A separate tool is required for each size anchor. To use, the anchor is lightly screwed to the threaded end of the handle. The anchor is then placed in the hole at the desired depth. Turning the handle while holding the knurled sleeve will expand the anchor in the hole, Fig. 12. When suitable setting tools are not availa-

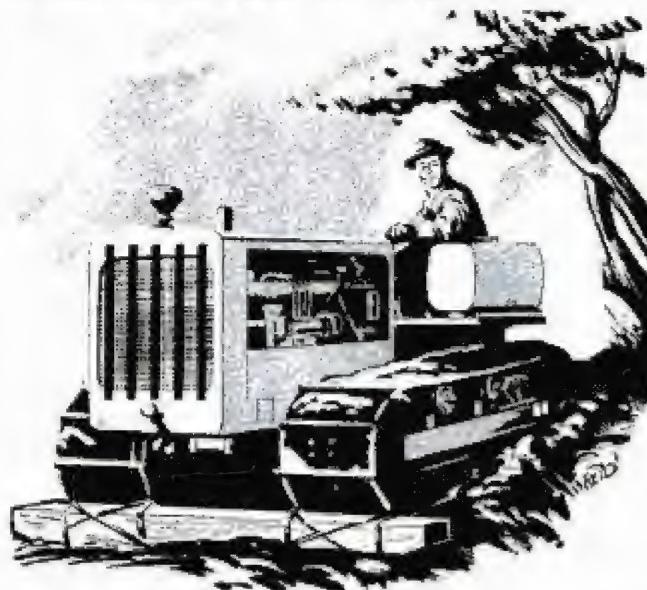
ble most users employ simple substitute devices. One is a block of scrap wood with a hole in it to take the screw. The anchor is screwed lightly to the block, the purpose of this being to obtain sufficient tension to prevent the anchor from turning in the hole, Fig. 13. Further turning of the screw expands the anchor, Fig. 14. Some pressure is needed to do this, especially if the hole is a trifle oversize. Use a long screwdriver, or, better still, take up the anchor with a hex nut and wrench, Fig. 15. It should be noted that hammer-setting drives the lead sleeve back, Fig. 6, while screw-setting pulls the expansion nut forward, Fig. 7. If the hole is oversize, the expansion nut will pull forward beyond the wall surface, Fig. 7. Normally, in a hole of the correct diameter, the anchor will grip tightly without the need of excessive setting.

Concrete nails: The fastest and cheapest device for anchoring in concrete is the hardened concrete nail. You can buy these in round or square-twist style. The nails should be driven through wood and into the concrete—not directly into concrete because they will bend, or perhaps ricochet, if not struck squarely. A uniform gauge, No. 9, is commonly used for all short lengths. Pilot holes drilled through the wood usually are necessary to guard against splitting. The principal use of concrete nails is in the application of furring strips, Figs. 17 and 18. If anchors are used for this work, the simplest application is to drill right through the wood and into the concrete; a washer is then used over the screw as shown in the detail, Fig. 19. By using a $\frac{3}{8}$ -in. washer on a $\frac{1}{4}$ -in. flat-headed bolt, the latter can be drawn up flush on pine furring strips without countersinking the bolt head.

Other devices for anchoring to masonry: With an understanding of the shield and anchor as described, you will have no trouble in installing other similar devices. Worth noting is the type of anchor commonly used when the head of the bolt is to fit in the hole, Fig. 20. Using a lead sleeve, this is an anchor instead of a shield and, like all anchors, is set by expanding the lead sleeve. In this instance, setting is done with a length of pipe or tubing. Separate lead sleeves and hard metal cones also are available for this work and can be used with any style of bolt. Separate sleeve-and-cone units also can be used on top of regular anchors to obtain a longer and stronger gripping surface, as may be needed in soft masonry. ★★★

Flat spots ground on the shanks of twist drills will make it easy to tell them apart from carbon drills and, if necessary, make choosing by touch possible.

Tractor Bogged Down in Mud Freed With Aid of Timber

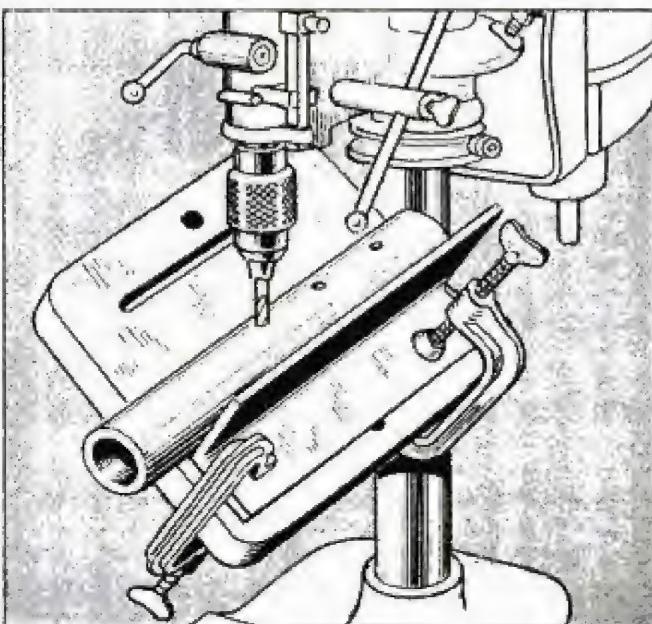


If a track-driven tractor becomes bogged down in mud, it can be driven out under its own power by lashing a large timber to the tracks as shown. This is done by encircling the beam with small cable and running it through links in the track. Secured at the front end, the timber is drawn under the tracks to the rear when power is applied, supplying extra traction.—Cpl. Elmer E. Foley, San Francisco, Calif.

V-Block Formed From Angle Iron Clamped to Drill-Press Table

A V-block for holding large-diameter work on a drill press can be provided by tilting the work table at a 45-deg. angle and clamping an angle iron to the table top as shown. The work is positioned under the drill by swinging the table and sliding the work in the vee until the punch mark is aligned beneath the drill.

C. W. Woodson, South Bend, Ind.



Tape Markers on Sheet Metal Speed Cutting Operation



When cutting sheet metal on a shear located in an inadequately lighted section of a shop, one operator found it difficult to make out marks drawn or scored on the metal when peering down between the pressure bar and the cutting blade. To remedy this, he applied strips of tape at the edges of the metal as shown.

Show Cards Held for Painting By Piece of Weather Stripping



the use of thumbtacks. On large drawing boards, a small piece of weather stripping may be attached in one of the upper corners for holding copy.

Making Your Own Paint Remover

An effective preparation for removing paint and varnish may be made by mixing equal parts of amyl acetate, acetone and benzol. Amyl acetate ordinarily is sold under the name of banana oil. All three may

be obtained from any drug or paint store. The remover is applied with a rubber-set brush or cloth swab and allowed to stand for several minutes, after which the paint may be wiped off with a cloth. Although this mixture is not seriously harmful to the hands, gloves should be worn to prevent that "dried-out feeling" that results when the oil from the skin has been dissolved. As in the case of other paint removers, this compound is flammable and therefore should not be used near an open flame.

Hacksaw Blade Repaired With Sheet-Metal Clip



If you have broken your last hacksaw blade and no others are available, you can splice the broken blade and continue to use it. Overlap the two broken pieces of blade 1 or 2 in. to suit the saw-frame adjustment, and notch them simultaneously on an emery wheel. Then make a repair clip 1 or 2 in. long by bending thin sheet steel around the notched joint. Drill this for a small bolt to hold the clip in place.

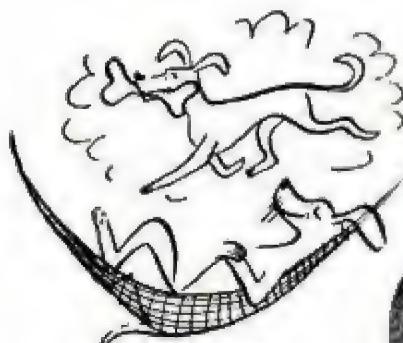
Carl S. Bates, Chicago.

Geese Used to Control Weeds In Farm Strawberry Patch

To keep grass and weeds under control in his strawberry patch, one farmer "pastured" several geese in the patch after the plants had finished bearing for the season. The geese fed solely on the grass and weeds but did no damage to the berry plants. The only care they required was a supply of drinking water. This was furnished from a water barrel to which an automatic-float waterer was attached.

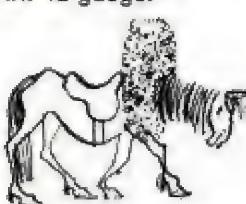


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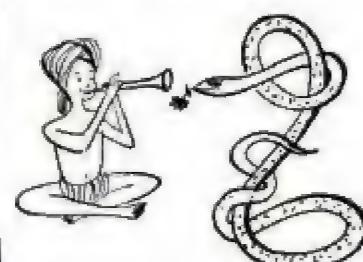
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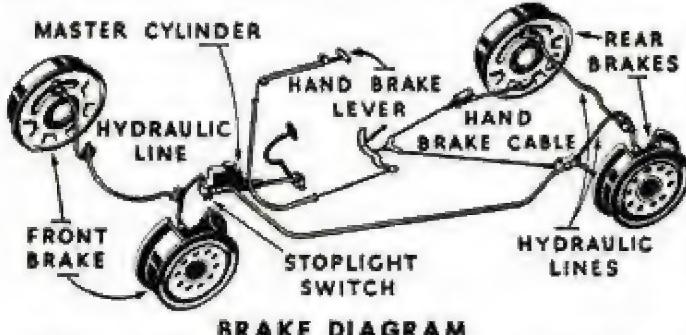


Care and Feeding of Engines

BY S. P. CORP

HOW TO TEST YOUR BRAKES

FIRST: Depress brake pedal slowly. It should move freely the first half inch; if it does not, it needs adjusting. If free play is correct, depress pedal as far as possible and check distance to floor board. If less than 2 inches, brake shoes need adjusting. Excessive pedal travel indicates worn brake linings.



SECOND: Right front wheel should be pulled for brake lining inspection, as this brake usually shows most wear. If rivets are rubbing brake drum, brake shoes need relining. Spongy action of brake pedal shows air seepage in hydraulic lines. Have air removed and make a complete check of wheel cylinders, master cylinders and brake lines.

HAND BRAKE: If your hand brake lever does not give sufficient braking power, when pulled out five notches, to hold against pull of engine, hand brake needs adjusting.

IF YOU HAVE VAPOR-LOCK . . .

Should your engine refuse to start after running on a hot day, you probably have a bubble of vapor gas at the high point in your fuel system, known as vapor-lock, which renders your fuel pump inoperative. Lift the hood and let the engine cool. Sometimes it helps to apply a wet cloth to fuel pump and gasoline lines to the carburetor.

Inspect fuel lines from tank to carburetor to see if a line has been bent up to cause a high point, which needs straightening. Other corrective steps include insulating lines with a wrapping of foil, relocating lines away from heat, shielding lines with asbestos or using heat shield deflector to direct fan blast past pump and lines to carry away heat.

NEXT TIME YOU RE-RING . . .

When your engine starts to burn oil, true economy calls for re-ring at once with a Sealed Power KromeX Ring Set—to end oil waste and gas waste, and to fight heat, friction, abrasion, and corrosion. Write for free booklet, "MORE POWER, Less Oil, Less Gas." Address Sealed Power, Dept. G-8, Muskegon, Michigan.



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Brick Discoloration



Q—I have a new home built of brick and some time ago I noticed an unsightly discoloration on the wall beneath the gutter. The affected area stays damp for some time after a rain and as it slowly dries a white powdery substance appears at the edges of the spot. What is causing this and what can I do to prevent its recurrence?—M. B., Mass.

A—It's rather hard to say positively at such long range, but we would guess there's a leak either in the gutter or in the roof at a point over the plate. In this we are assuming that the cornice is of the so-called "flush" type. It is comparatively easy to locate a leak in the gutter by damming it and filling with water from the hose, but to discover a leak in the roof will require a more careful examination. The leak may be at a point some distance above the plate and directly over a rafter. Water runs down the rafter to the plate and from there seeps down onto the outside of the wall. One sure way to discover the whereabouts of the leak is to go into the attic during a rainstorm. Once the leak is located, mark the spot so that when the roof is dry you can go in the attic and drive a small nail through the roof boards and the shingles. The projecting nail will enable you to locate the point when you get up on the roof to make the repair. Scrubbing the affected area of the brick wall with a trisodium-phosphate solution will remove most of the discoloration. When thoroughly dry, coat with a masonry sealer.

Care of Mounted Trophy Head

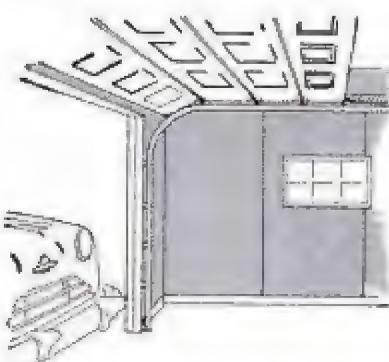
Q—I have an exceptionally fine 8-point deer head I would like to keep as long as possible as a trophy. Lately I've noticed that the skin around the nostrils and mouth appears to be shrunken somewhat and several fine cracks have appeared. The antlers have lost their original brilliant sheen. However, the hair appears to be in good condition yet and there are no indications of moth infestation. How does one care for such a head and prevent it from deteriorating too rapidly?—W. T., Tex.

A—In general, the head should be cleaned two or three times a year by brushing with a soft-bristle brush. This will remove accumulated dust and straighten the hair so that it lies naturally. Sometimes it is helpful to go over it with a damp cloth, and if it is rather badly soiled it is permissible to shampoo the entire head lightly with a mild-soap

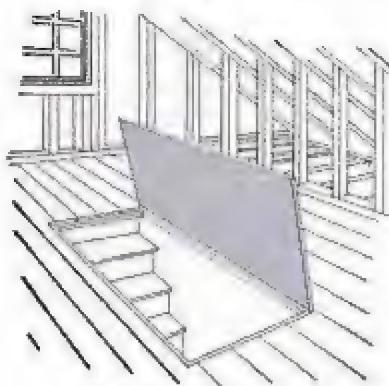
(Continued to page 208)



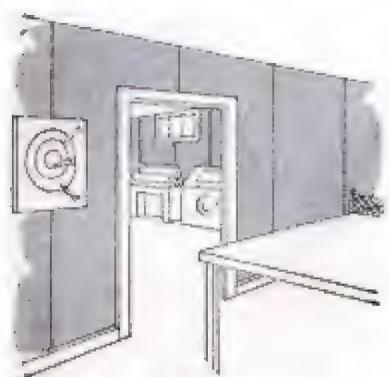
Jobs you can do with Armstrong's **TEMLOK BOARD**



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Insulate attic trap door



Build playroom walls

There are dozens of places in your home where you can use Armstrong's Temlok Insulation Board.

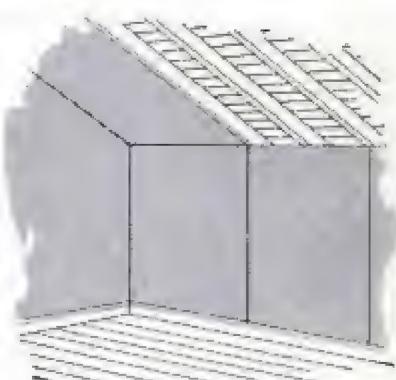
Temlok is the low-cost way to finish walls and ceilings of any extra rooms you may be adding in the attic or basement. It's useful, too, if you're converting an open porch to inside living space. If you're building a summer home and want to keep interior finishing costs down, Temlok Board is your answer.

Temlok is a pre-finished fiberboard material. It builds, decorates, and insulates in one operation. Temlok comes in 4' widths, and lengths up to 12'. Its big size speeds application, minimizes joints.

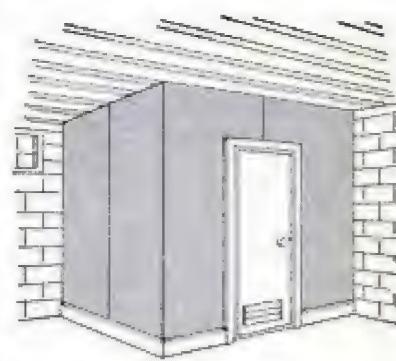
This material is available in two types. Temlok Insulation Board is $\frac{1}{2}$ " thick, with a two-coat, Light Ivory finish. Temlok Wallboard is lower in cost, comes $\frac{3}{8}$ " thick with a textured Ivory finish. Both are easy to work and handle.



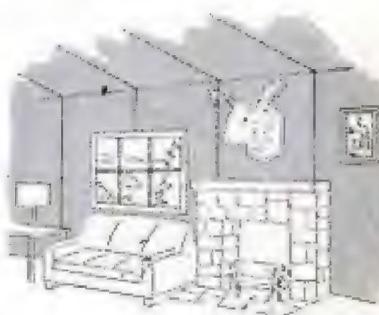
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Finish attic walls



Build darkroom



Finish cabin interior

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POL-MER-IK'S 101 HANDY USES:



ARCHER
Pol-mer-ik
LINSEED OIL
PROTECTS MOST EVERYTHING

(Continued from page 206)

solution. However, extreme care should be taken not to wet the skin or rub the hair against the "lay." Wipe immediately after shampooing, using several soft cloths to remove all the water from the hair before permitting it to dry. Clean the antlers with mild soap and water and when dry, wax and polish them to a medium luster. Ordinary furniture wax, or paste wax, will serve this purpose. Cracks in the skin around the nostrils usually can be filled with a wax crayon of matching color and the skin can be softened by coating with neat's-foot oil. Coat the skin and allow the oil to absorb for a few minutes, then wipe off the excess. After cleaning, the head should be treated with a suitable moth repellent.

Attic Louvers

Q—Recently I purchased an old house. There are windows in both ends of the attic, but the remodeling I'm planning calls for removal of these and the installation of ventilating louvers. The roof pitch is quite steep and the attic space is high, narrow and long. How does one determine adequate louver area? What is the meaning of "free area"?—J. F., Minn.



A—Referring to attic louvers of the type usually supplied, perhaps the easiest-to-understand definition of free area is simply the area of the louver opening less that of the slats. In installing louvers it's a fairly general rule to allow 1 sq. ft. of free louver area for each 100 sq. ft. of attic floor space. In a high, long attic such as you describe, it's probably advisable to install louvers somewhat larger than the requirement in the gable ends. In some cases, roof vents are installed along the ridge in addition to the gable louvers. When this is impracticable, screened vents are installed in the cornices. It is assumed, of course, that you plan to insulate the attic floor adequately as the remodeling job is carried out. The louvers should be tightly screened to keep out birds and insects.

Ventilated Sump

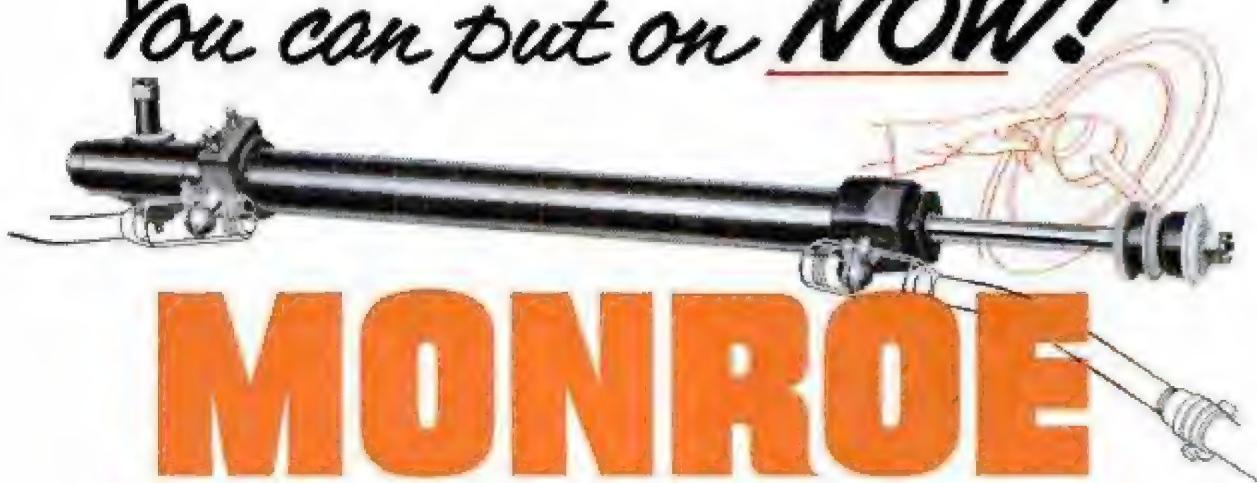
Q—In our new home we have a sump pit and pump installed in the basement floor. I've tried every way I know to eliminate the odor from the sump without any apparent success. Cleaning once every two weeks and applying a deodorizer gives only temporary relief. In a few days the odor is as bad as ever. What can I do?—T. Y., Okla.



A—Apparently you haven't thought of installing a vent to the outside. In most cases, the remedy is to cast a two-piece concrete cover for the sump. Build a semicircular form for each half and locate a semicircular block in each to form an opening for the pump-shaft housing. The forming blocks should be cut on a radius only slightly larger than that of the shaft housing. Before pouring the cement mix, place a short length of 3-in. galv. pipe upright in one form. Then pour concrete in both forms and allow to cure for a week to 10 days. Keep the concrete dampened as it cures. Then remove the halves of the cover from the forms and place in position over the sump, using calking compound to seal the opening between the halves, around the shaft housing and at the edges of the sump opening. The vent pipe, which is connected to the short length cast into one of the cover halves, can be led up through a partition to the roof or to the outside through the basement wall. In either case the open end should be covered with a conical sheet-metal cap to keep out rain and snow.

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can put it on your present car!*

Here at last is a Power Steering unit your car dealer or service garage can install in just a few hours! Now, for the first time, owners can enjoy the benefits of power steering on cars not equipped with a unit by the factory. Monroe Direct Action Hydraulic "Power-Guide" is the surest, safest, simplest device yet developed for taking the work out of steering. You will drive in greater safety, you will enjoy effortless steering that makes day-long driving an untiring pleasure when

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SIMPLEST

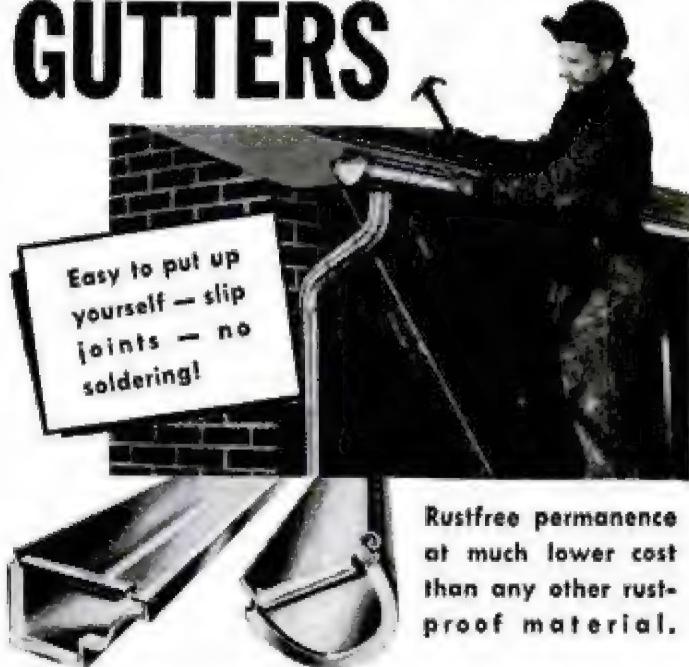


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Midget Yachts Race for Fun

(Continued from page 100)

farther aft when the wind is strong. To make the change, it was necessary to slack off the rigging, restep the mast, tighten the stays once more and then retune the sails.

The operation took considerable time so Lassal tried an experiment with "Zip." He mounted the mast, sails and rigging on a slide that he fitted into a track attached to the deck. With this he could shift sails and all to any desired point in a matter of seconds. The sheets that control the set of sails are attached to the sliding rig. They may be loosened to allow the sails to swing out when the wind is aft.

One of the first who experimented with vane steering was a French sailor who wanted to cross the Atlantic singlehanded in the '20s. He rigged a large wooden vane at the end of an arm pivoted on the stern of his boat and hooked the arm to his rudder tiller. Any shift in the wind that might throw him off course would change the angle of the vane, thus moving the rudder in a direction that kept the boat on its original heading. When this gear was balanced for the direction he was sailing he could go to sleep knowing that his "automatic pilot" would steer the boat skillfully all night long.

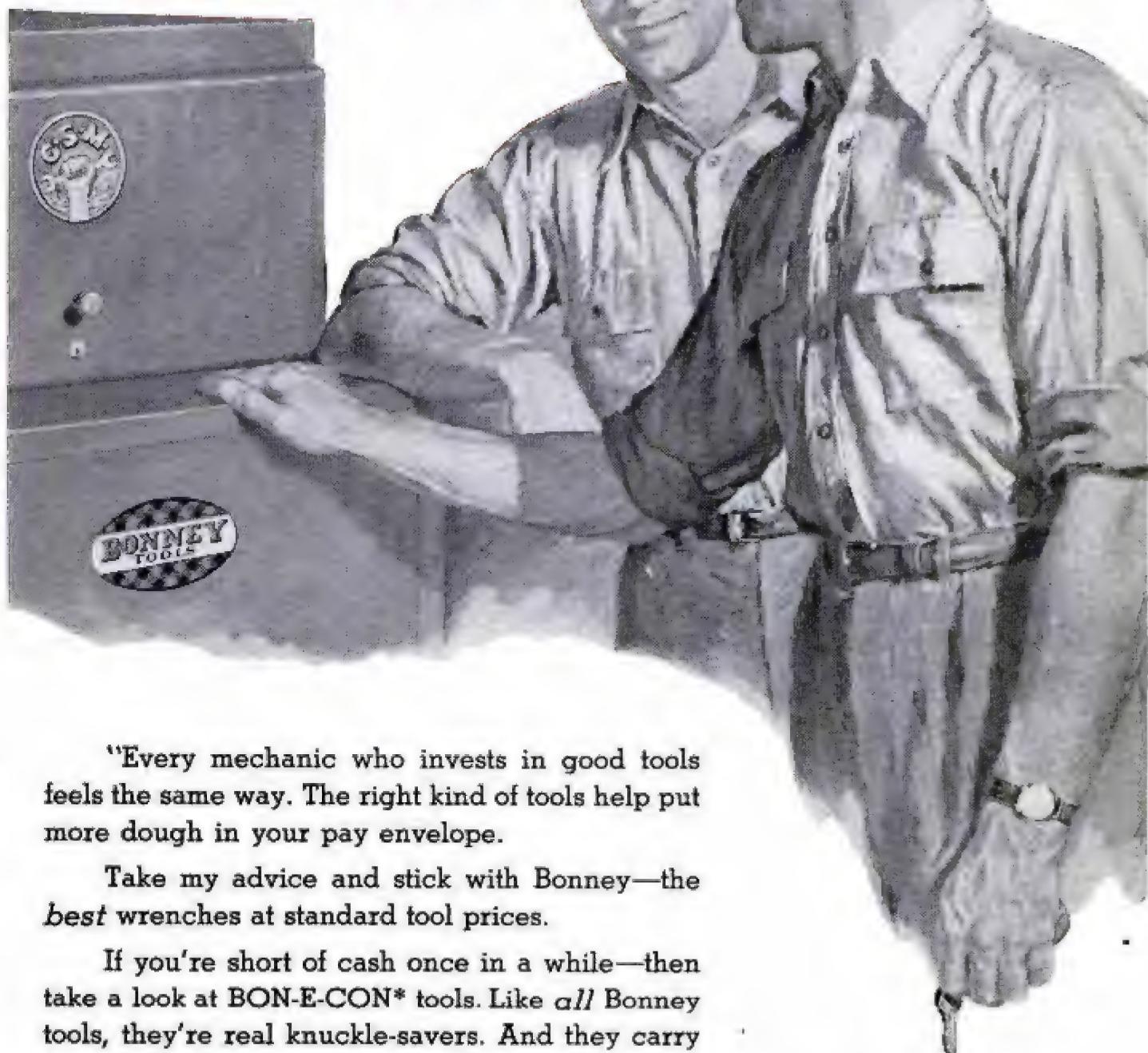
It wasn't long before the idea was adapted to model sailing craft. For the first time the model-yacht skippers had a way of positively controlling the direction that their boats would steer. Today no one would think of starting a race until he had installed the "feather" and adjusted its mechanism. One attachment for vane steering brings the boat around on the other tack each time the wind dies down for a moment. In a long race the boat can be expected to tack several times, always working its way up against the wind.

There are several semiprofessional modelmakers who turn out racing craft for \$100 to \$500, though most models are built by their owners at a cost of about \$40 plus considerable time. Construction plans are available. Such equipment as weighted keels, vane-steering gear and sliding rigs can be purchased complete and installed on home-built models. Information about model-yacht racing and construction can be obtained by writing C. O. Davis, Model Yacht Racing Association of America, 2113 18th Street, Everett, Wash.

You have your choice of several sizes of models if you decide to build one, all the way up to the big international A class that is built to a formula and weighs from 40 to 70 pounds. An A boat has from 1300 to 1800

(Continued to page 212)

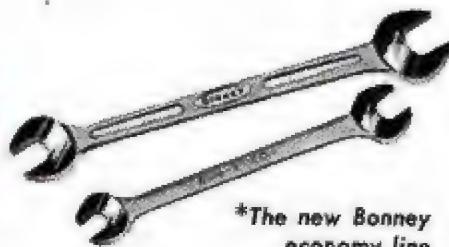
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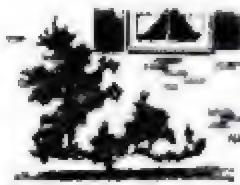
BUILD STRONGER MODELS. Quick-drying "Duco" Cement is standard equipment with most model builders.



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square inches of sail area. Height of its mast is limited to 85 inches. The international M class is smaller, with a sail area limited to 800 inches. Smaller, too, are the scale-model six-meter class, the 50-inch "Sun Kiss" and a 36-inch class. The A, M and six-meter classes are popular abroad as well as here. This year Canada has challenged the United States for possession of the international A-class trophy and a series of races for that cup will be held late this summer on one of the California sailing ponds.

Of growing importance is the experimental X class, a strictly American development. The principal restriction is that the sail area may be no greater than 1000 square inches. Left to the ideas of designers and builders are the length, breadth, draft, weight and other considerations, though freaky designs are discouraged. The X class is expected to develop the fastest hulls that can be driven by 1000 square inches of sail in any weather. Already X boats with long water lines have proved to be faster than any other class, except that in very light winds a big A boat with its much larger sail and a spinnaker (not permitted in the X class) can sometimes outrun its smaller competitor.

There will be still another new class if Gus Lassal has his way. He's sponsoring a proposed 40-inch L class distinguished by a "finless fin" keel. Also called a keel with a recessive leading edge, the finless fin extends down near the stern of the boat and then angles forward so that most of its weight is at the proper center of balance. Lassal first suggested the finless-fin keel some 15 years ago and it has been outlawed for all of the existing classes along with such other unconventional innovations as outriggers and movable inside ballast.

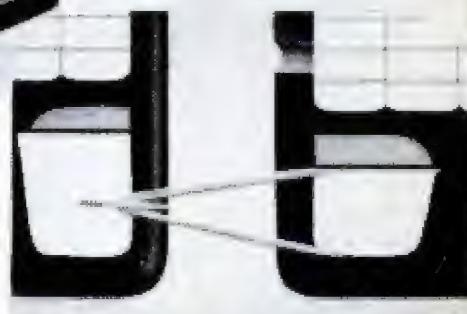
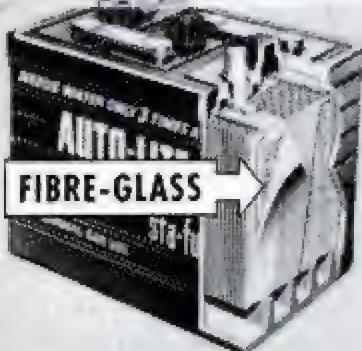
Gus argues that his L class with its finless-fin keel will prove so fast in the water that eventually this type of keel will be permitted on all classes of boats. The recessive keel doesn't contribute directly to a boat's speed, he says. It reduces turbulence and drag and thus improves the behavior characteristics of the hull, permitting the boat to move along at a faster speed than it could otherwise.

Still another new development, one that puts the model-yacht skipper in complete control of his boat at all times, is remote control. This month, the third annual championship race for the DX remotely controlled X boats was to be held in Seattle. The winner earns possession of a \$500 cup. Most remote controls employ a single-channel radio frequency that operates a below-deck motor, which in turn hauls in

(Continued to page 214)



*AUTO-LITE "Sta-ful"
needs water only
3 times a year...
lasts longer, too
Here's why—*

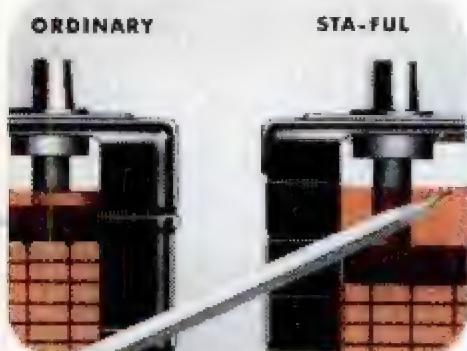


ORDINARY STA-FUL

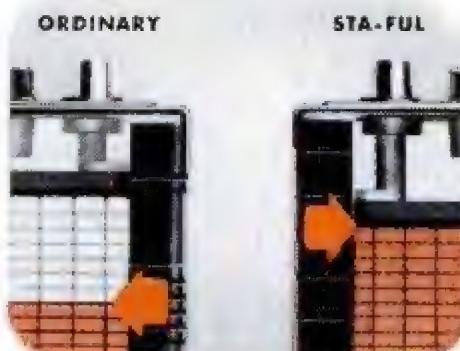
1. Auto-Lite "Sta-ful" has Fibre-glass retaining mats that help keep power-producing material in place to reduce plate shedding and flaking.

2. Because this flaking in ordinary batteries can short circuit plates and cause failures, a deep sediment well is necessary in ordinary batteries to catch flaking waste.

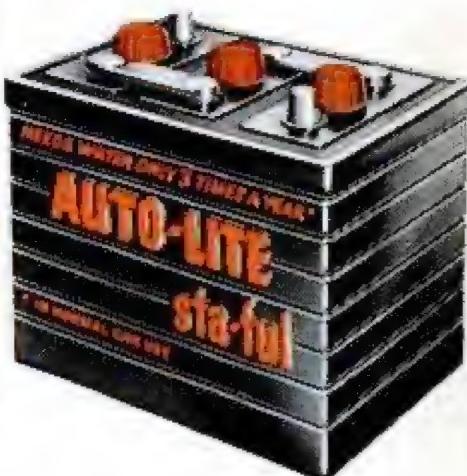
3. Fibre-glass mats, therefore, permit Auto-Lite engineers to lessen sediment-well depth in "Sta-ful," adding extra space above battery plates.



4. This additional reserve over plates gives "Sta-ful" more than 3 times the liquid reserve of ordinary batteries, helps keep plates fully covered and active longer . . .



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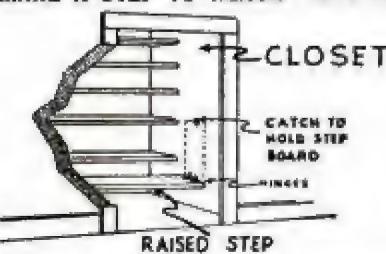
HOW TO HANG A DOOR

Fit door in opening. Do not bevel the hinge side. Measure down seven inches from top of jamb, and eleven inches from the floor. Mark with knife or chalk. Then take a $\frac{1}{4}$ " chisel. Hold half of chisel on door and half on jamb and hit chisel.



Suggested by George Hogerty 908 Wolff Denver, Colo.
He receives a Tufboy.

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WOOD AND STEEL TAPE RULES

the sails or lets them out. In Los Angeles, Mel Heflinger is working on a radio rig that not only controls the set of the sails but also makes adjustments to the vane-steering mechanism.

Among the most pretentious radio-controlled yachts is the 72-inch schooner "Beatrice" built by Harry J. Rogers of Los Angeles. Rogers converted the hull of an X-class racing sloop to a schooner rig and equipped it with hatches so that he could install batteries, motors and a seven-tube radio receiver below deck. He controls this equipment with a four-channel transmitter of the type by which small-target drone aircraft are steered in the air.

Standing on the beach with control box in hand, Rogers can tack his boat back and forth across the wind, pay out the sheets and turn the rudder to bring the boat on a cross-wind or down-wind course and, finally, if the wind dies down, bring all sails amidships and start an auxiliary electric motor on board that will bring his miniature yacht right up to his feet under power. He can control the boat while it moves around an island, out of sight. His transmitter has a 20-mile range. The receiver, motors and other equipment on board weigh 11 pounds, giving the "Beatrice" a total weight of 36 pounds. It is a cruising boat, not intended to be raced.

The regulations of the DX class stipulate remote control and do not limit control mechanisms to the radio type. Some model yachtsmen are talking about controlling their craft by means of sound waves that would actuate the gear on board, and one of them proposes to control his boat by ultrasonic vibrations that would be transmitted through the water and picked up by special hydrophones attached to the hull.

In the realm of new ideas, the model yachtsmen are leaving their brethren who own full-size racing craft far behind. ★★★

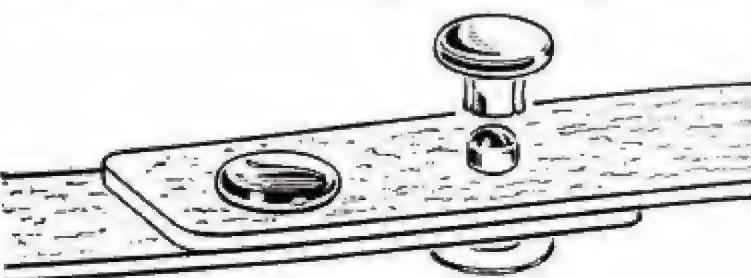
Develop Three-Dimensional X-Ray Motion Pictures

Three-dimensional movies of the body's interior are possible with a system developed at the University of Rochester. Only one camera is used. The necessary image shift is produced by the steady rotation of the patient in a revolving chair and the movement of an X-ray tube in an arc directly opposite the camera and on the other side of the patient. Two prints of the same film are made and projected from synchronized machines, one film leading by several frames to produce a "looking around the corner" effect. The images are projected through Polaroid filters onto a metallic-surfaced screen.

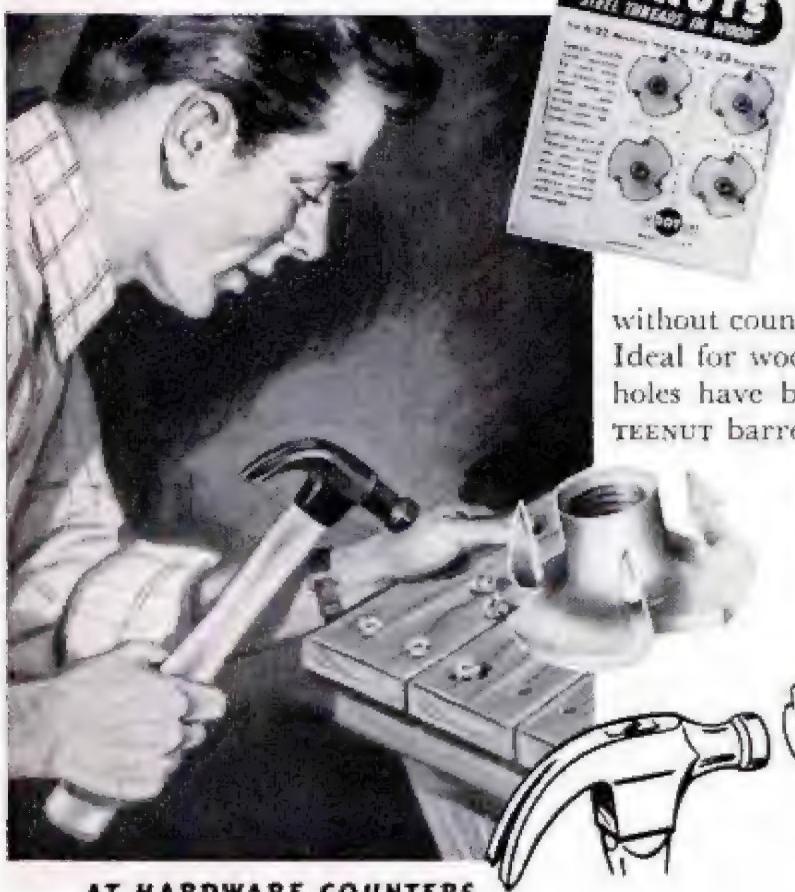


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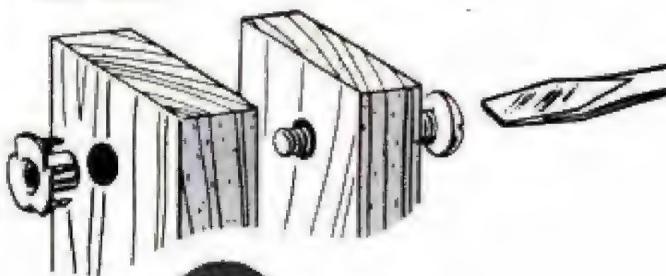
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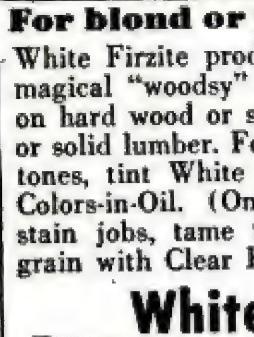
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These Fabulous Tools Unlock the Atom's Secrets

(Continued from page 93)

at the University of Illinois. A different type is a six-mev accelerator at Stanford.

Prof. Edward L. Ginzton, director of Stanford's microwave laboratory, believes that linear accelerators of this power could be manufactured commercially for little more than the \$15,000 price tag of conventional 200,000-volt X-ray machines. At a cost like this almost every hospital could afford this far more powerful X-ray source.

In a few years, probably, physicists will be watching the completion of an accelerator far more powerful than they had dreamed. This is the 100-bev strong-focus synchrotron recently announced by the Atomic Energy Commission. It appears to be practical because of the discovery of a new principle for focusing by strong magnetic fields; this was developed by a research team at Brookhaven. It is estimated that its magnet and tube will be close to half a mile in diameter.

What could be expected of an accelerator like that?

In the first place, it undoubtedly would substantiate many of the findings that our present large accelerators are expected to help make in the next few years. Some speculate on the possibility of making "reversed matter" when 100,000,000,000 electron volts of energy are available. Electrons normally have a negative charge and yet physicists already have created positive electrons, called positrons. With great power it might be possible to create negative protons in the nucleus. An atom of "antihydrogen" would have a positron revolving around a negative proton as the nucleus.

Already, however, with their present equipment the physicists are duplicating under controlled laboratory conditions some of the nuclear disintegrations that occur in the medium range of cosmic radiation. Mesons, for instance, were first observed in cosmic-ray studies; a number of the newest accelerators are powerful enough to create them at will. In fact, several types of mesons have been "manufactured" and identified.

The mysterious V-particles, recently detected in cloud-chamber photographs of cosmic-ray disintegrations, also may prove to be associated with the nuclei of atoms. Right now, there's no telling what new information will be gained from research with the powerful new tools.

As Professor McMillan says, "Nuclear physics is a well-established subject; sub-nuclear physics is only in its infancy." ★★★

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School for Camera Sleuths

(Continued from page 143)

Addison. Private and municipal investigators must be able to trust the ethics of the photographer who is among the first on the scene of an accident or crime. And as they discover the importance of complete honesty, Brooks students get a line on the fakery and retouching they may be up against in court from unscrupulous photographers. They must learn to detect tampering on negatives and to analyze lenses and lighting. They may have to show that the lighting in a picture has accented or hidden some important evidence. Or, if someone is suing over a flight of stairs that is said to be too steep and to have caused an accident, photos could be introduced taken with short-focal-length lenses to make the stairs look far more precipitous than they are. The investigative photographer has technical knowledge to combat such practices.

During their course at Brooks, students consult with lawyers and police to get acquainted with current cases. A half dozen Brooks men can be found peering into their ground glasses at the scene of an actual fire before the embers are cold. Addison tries to make his classes as real as possible so that graduates will fit quickly into the world of law and the camera.

Not long ago an ex-GI student was amusingly embarrassed by his classmates after he spent his lunch hour writing a letter to his girl on a pad of paper. When he had finished and left, fellow students swooped down and grabbed the blank pad he had left behind. Lighting for high contrast from the edges, they photographed the impressions made by their hapless colleague's pen as he bared his thoughts. Two hours later they casually hung a print of the poor guy's letter on the bulletin board. Addison had to give them an "A" in initiative, though it took the victim a while to see the joke.

As a final problem, Brooks legal eagles must photograph and document a crime scene set up for them with all the skill and trickery at the command of teacher Addison. They find old tire marks, broken grass, scraps of paper, odd weapons and a list of suspicious stuff waiting to be pictured and fitted into place as evidence. Each student writes his own report using his pictures to back up a personal analysis of the scene. Their cameras and eyes are challenged. But they learn to play for keeps as they must with real criminals or in actual civil cases they may later face.

★ ★ ★

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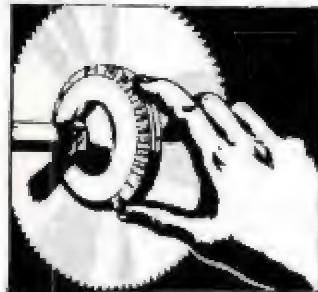
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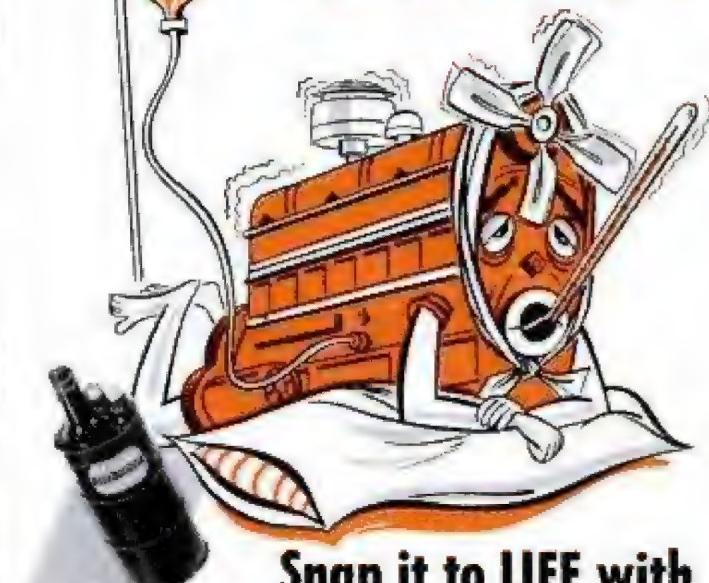
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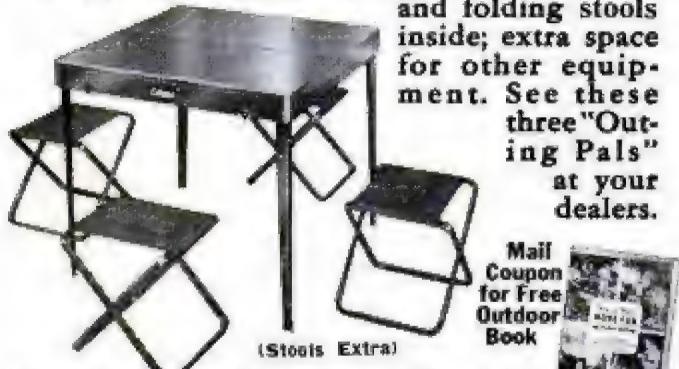
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Mapping the World With the "Educated Dot"

(Continued from page 117)

prospects and virgin timber stands in unknown areas throughout the world. The dot is also busy at rather prosaic jobs, such as measuring for tax purposes the amount of mined coal in the various stock piles of sprawling coal lands.

At the end of World War II, by a cloak-and-dagger escape worthy of an adventure story, a German named L. Bertele left the custody of the Russians in East Germany and hurried to Switzerland. Why was Bertele important? He is the acknowledged foremost lens designer in the world, the man who, among other things, produced the famous Sonnar lens of your Contax camera. Besides his own desire to be elsewhere, he was needed in Switzerland for the challenging problem of designing an entirely new wide-angle lens for the educated dot. A greatly improved lens was needed because the dot, fully capable of checking its own work, was in those days constantly showing up errors in the maps that proved to be nothing more than the fault of the camera lenses.

Bertele produced his masterpiece, the Aviogon lens, after four years of research and testing. The lens is entirely new in design—more like a telescope than the usual short wide-angle lens. It is of full 90-degree coverage. Some of the elements in its 10 optical-glass parts (the materials used in a lens are as important as its shape) are rare.

One serious defect of former wide-angle lenses has been that their brightness factor was reduced toward the outside of the picture. In other words, dim edges. The new lens gives three times the usual brightness at the edges.

Faults of equal importance were the resolving power and amount of distortion in wide-angle lenses. The Aviogon is needle-sharp, about an 80-percent improvement on former lenses. Of interest to the amateur photographer is that the new lens, to all practical purposes, has no distortion at any diaphragm opening.

Today amateur photographers must forego this superlens—it is only made in large sizes and with its rare elements and unusual grinding, costs approximately \$4500 per lens. But the problems of mass production of similar lenses are being studied, and the Aviogon definitely heralds a marvelous new lens for your camera one of these days.

The precocious little dot has also stimulated improvements in the aerial cameras. The latest camera shuffles its negatives as

(Continued to page 224)

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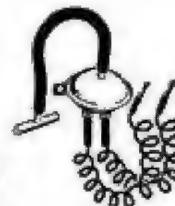
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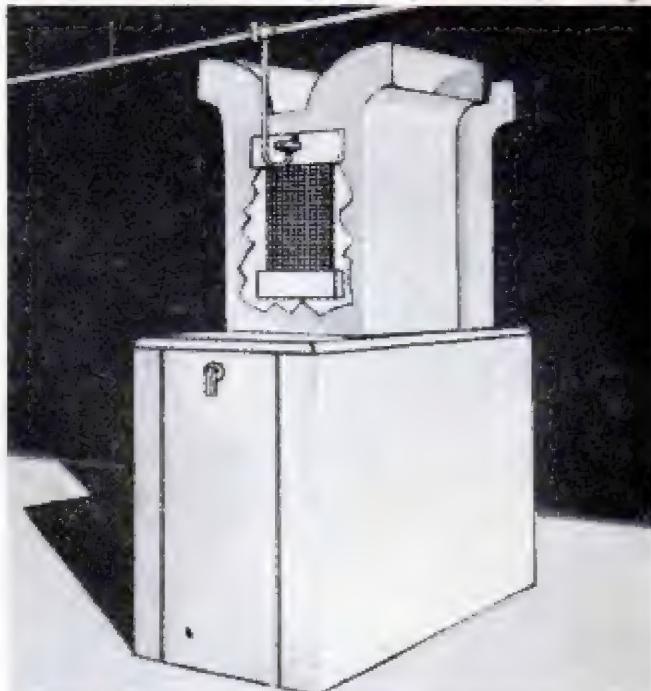
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busily as a canasta player. This new camera slips plates one at a time behind the lens, using glass negatives because glass is not subject to the expansion and distortion of roll film and thus captures the full precision of the lens for the educated dot. The camera holds 80 glass negatives of six by six-inch size in two magazines and automatically shuffles them behind the lens as the airplane flies over the land. Another new wrinkle is a mechanism in the camera that allows the photographer to keep the camera snapping at a speed which makes each photo overlap the next any desired amount, regardless of the wind speed or any change of plane speed.

Because the operation of the educated dot is a highly technical matter, engineers must be trained. The Netherlands started an international college for this purpose in 1951. It offers a one-year course to any college graduate of an engineering school and to any other interested person, such as a forestry or agricultural student, who has had sufficient mathematics. Paid scholarships are granted to the college through the United Nations. ★ ★ ★

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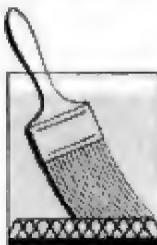
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The Men Behind the TV Scenes

(Continued from page 126)

others transform a long, shapeless, cloth-covered frame into sea-battered rocks on which mermaids will bask for their few minutes before the camera. Several artists are busy drawing and painting backdrops and flats. Their work is made easier by control buttons at one end which move the canvas up or down at the touch of a finger. In this department, the lower floor of the two-story set was changed into a dingy, tenement-basement room, with pipes painted on the walls and a coal chute in the back.

While his designs are taking shape, the art director and the head prop man go out to rental decorating studios to choose the furnishings, draperies and properties. "Selecting," as they call it, takes from three to five hours for each show.

Two days before a telecast, the scenery is finished down to the last brush stroke and removed from the paint frames.

"Then we hang!" Jerry Decker announces. "Or 'dress' our sets, as we call it. For an All Star Revue, Earl Curtis and his stagehand crew mark on the floor where each item goes. The backdrops are tied to lines to be pulled up into the flies, ready for use, and the head prop man and his helpers hang all the curtains and draperies and place the props. Before we're through, each man knows exactly what flat, what chair or book he is to put into position and where. That's why, in the high pressure of an actual telecast, our scenes change like magic and we're always ready on time."

Now, all that is left to be done, as far as the settings go, is to make minor alterations when they go on camera and lights for the first time and during the full-dress rehearsal the day of the show.

TV stage production is a marvel of cooperation, even more so than in the theater and motion pictures. Without the skilled contribution of each department—construction, scenic, properties and stagehand—designs could never become finished sets.

The late Max Rée used to say, "For sensitive people, TV is a hard school. We never have time to do things as well as we know we can. We do our best but never come to the point where we can say, 'That's it!' Whatever man creates, he likes to stop for a minute and enjoy, but there's no time for that in television. We rush from one scene into another, from one week's show into blueprints for the next."

But they love it. From their first rough sketch to their credit line on the "crawl," these men enjoy every minute of the excitement of setting the stage for pictures seen for a few brief moments.

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Repair stripped, damaged or poorly tapped threads in seconds on the assembly line with *Heli-Coil*® screw thread inserts. New threads are original size and stronger than before, last forever in metals, plastics, wood. Needed *Heli-Coil* tooling — usable forever — costs as little as \$15 per thread size. Inserts as little as 3¢ each. Fine, too, for quick, economical field repairs. Available for all thread sizes, including spark plug and pipe threads. Write today for complete facts and illustrated instructions.

*Reg. U. S. Pat. Off.



Worn, torn, chewed up, corroded threads that won't hold.

Threads stripped? Repair in Seconds...



Smooth, strong, clean threads that add strength and can't pull out.

HELI-COIL CORPORATION



388 Shelter Rock Lane, Danbury, Conn.

Please send full information on
Heli-Coil® inserts.

Name _____

Address _____

City _____ State _____

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OIL FACTS AUTO-TRUCK-TRACTOR OWNERS STOP CHANGING OIL!



Impossible? Just send for free 32 page book, "Oil Facts" and judge for yourself — you'll be amazed. Learn how air lines, bus lines, etc., save on oil!

RECLAIMO, 5083 Elston Ave., Dept. M-B, Chicago, Ill.
Wm. Schwab Co., U.S. Pats. 1757223, 1834654, 2008473

WIN UP TO \$35,000!

Famous Super Sniffer for URANIUM PROSPECTING

Compact 2 lb. Geiger counter. Uses only 2 flashlight batteries. Highly sensitive to both beta and gamma. Signals with flashing light and headphone clicks. Guaranteed. Fully-repairable. Complete with radium source, headphones, batteries, book, "Prospecting for Uranium," \$49.50 post paid.

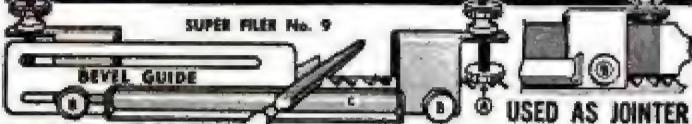
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nuclear-chicago, 255 W. Erie St., Chicago 10



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SUPER FILEX No. 9

BEVEL GUIDE

USED AS JOINTER

SO EASY with this new filing jig and jointer anyone can now sharpen any hand saws like new! When file hits hardened steel rollers teeth are finished and EXACTLY THE SAME HEIGHT. All teeth cut and saw runs true and smooth. Jig and instructions \$2.95 postpaid. FREE FOLDER.

SHARPEN YOUR CIRCULAR SAWS

The RIGHT WAY on your own saw table. Sharpens rip, cutoff, hollow ground and combination blades—8" to 10". Saws stay round with correct bevel. Precision made, easy to use. GUARANTEED. Only \$8.95. Includes \$3.00 Grinding wheel.

"TRU-CIRCLE"
saw set automatically sets teeth at 10° or more.
\$2.95

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Get This BIG Manual And Bargain Book

Loaded with how-to-do-it articles on wood-finishing, veneering, making inlay pictures and cabinets. Contains 83 distinct inlay designs and borders, plus a wood identification panel of 60 different varieties. All shown in full natural color suitable for framing.



A MULTITUDE OF MATERIALS

Lowest Prices On
Veneers Period Furniture Hardware
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Enclosed find 50c (refunded on 1st order) for
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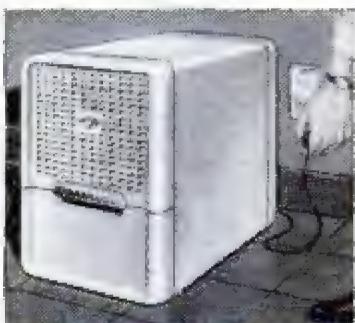
STOP MOISTURE DAMAGE FOR GOOD!

Just plug in
the amazing

FRIGIDAIRE

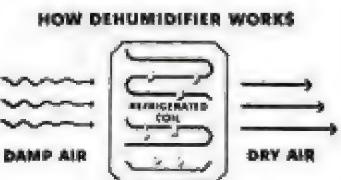
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Only 18½" high—
20½" long—11¾" wide



Positively controls moisture in any closed area up to 8,000 cu. ft. where moisture is a problem.

Fan circulates moisture-laden air over refrigerated coil. Moisture is condensed and collected in container. May be connected to drain. Dry, filtered air flows into room.

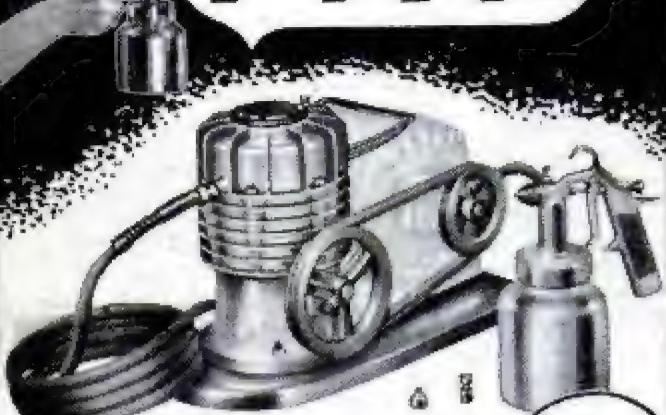


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Speedy Sprayer



Favorite of home owners and craftsmen for 20 years! SPEEDY SPRAYER gives your work that professional paint finish everyone admires. Sprays paint, enamel, varnish, lacquer, etc., . . . 4 to 7 times faster than hand brushing! Lightweight, portable, uses any 1/4 H.P. motor. Improved diaphragm principle assures clean, oil-free air. You'll find dozens of time and money saving uses for SPEEDY SPRAYER, including spraying insecticides 2-4-D and DDT. Complete outfit, without motor, only \$36.50.

At leading hardware, lumber, and auto supply dealers.
FREE—write for handy booklet "How to Spray."

ONLY
\$36.50
LESS
MOTOR

W. R. BROWN CORPORATION
2635 N. Normandy • Chicago 35, Ill.

Hams Bounce Signals Off the Moon

(Continued from page 148)

Radio Relay League at West Hartford, Conn. The rig at W4AO was maintained precisely on frequency and keyed in one-second pulses. The required separation in frequency between the transmitter and receiver frequencies (to take care of the Doppler effect resulting from movements of the earth and moon) had been calculated and the receiver frequency set with elaborate stability precautions. A wire recorder was then connected to the receiver output to catch as permanent evidence any sign of a returned signal.

This system operated continuously whenever the moon was in the right place, and no minor considerations like eating or sleeping were permitted to interfere. At long last, at 5:03 a.m. on July 15, 1950, came something that sounded like an echo. It was faint and indefinite, but it started at the right time and it sounded like the real thing. What was more important, it was caught on the wire recorder. It was just one tiny beep but it was enough to keep enthusiasm going. Copies of the recording were sent to QST, official organ of the American Radio Relay League and a few ham friends who could be trusted to say nothing until a more solid signal was recorded.

Project Moonbeam went on and on, in W4AO's basement shown in photo C. Test after test piled failure on failure, but still the beeps were sent and constant experimenting went ahead. Sketch A shows Ross, W4AO, left, and Bill, W3GKP, checking the alignment of a new stacked rhombic-antenna array in November 1952. This huge stacked rhombic was an improvement over the 32-element array. Ross and Bill were joined by Ted Tuckerman, W3LZD, of Dunmore, Pa., who erected a 30-wavelength rhombic-antenna array in time for tests in late January 1953. Ted arranged to listen for the ground-wave signal with his normal 2-meter antenna aimed at W4AO, and then switch to the moon rhombic to try for the echo. On January 23, positive results were received at W3LZD in a series of weak echoes, at a time when nothing was detected at W4AO. Tests the following afternoon produced nothing, but January 27, a whole series of echoes was recorded at W4AO, two cycles which are reproduced in Fig. 1, to provide convincing proof.

To the question "Where do we go from here?" Bill Smith has some ready answers. "This is the end of Phase A—we've got an echo. Phase B will be to transmit intelligence to another station." In other words, to make real two-way 2-meter DX available by using the moon as a reflector. ★★★

FOR RADIO AND TELEVISION REPAIRS



Model 670-A SUPER-METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS.

SPECIFICATIONS: D. C. VOLTS 0 to 7.5/15/75/150/750/1,500/1,500 Volts • A.C. VOLTS: 0 to 15/30/150/300/1,500/3000 Volts • OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts • D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1,000/100,000 Ohms 0 to 10 Megohms • CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Quality test for electrolytics) • REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms • INDUCTANCE: 1.5 to 7 Henries 7 to 7,000 Henries • DECIBELS: -6 to +18, +14 to +38, +34 to +58.

\$28⁴⁰

Comes complete with test leads and operating instructions.



Model TV-11 TUBE TESTER

• Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin number in the RMA base numbering system, the user can instantly identify which element is under test. • Uses no combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket. • Free-moving built-in roll chart provides complete data for all tubes. • Phono jack on front panel for detecting microphonic tubes.

\$47⁵⁰

Housed in hand-rubbed oak cabinet complete with portable cover ..



TV BAR GENERATOR

THROWS A NON-SHIFTING BAR PATTERN ON ANY TV RECEIVER SCREEN!!!

CONNECTS DIRECT TO ANTENNA POST. NO CONNECTION INSIDE RECEIVER

Features: Can be used when no stations are on the air. • Provides linear patterns to adjust vertical and horizontal linearity • Provides vertical and horizontal sweep signals • Provides signal for testing video amplifiers.

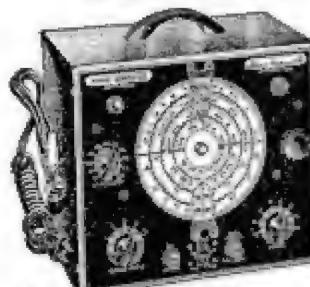
TV Bar Generator comes complete with leads and \$39⁹⁵
detailed instructions. Only ..

660-A
Model

SIGNAL GENERATOR

Provides Complete Coverage for A.M. — F.M. and TV Alignment

• Generates Radio Frequencies from 100 Kilocycles to 220 Megacycles. • Accuracy and stability assured by use of permeability trimmed Hi-Q coils. • R. F. available separately or modulated by the internal audio oscillator. • Built in 400 cycle sine wave audio oscillator, available separately for audio testing of receivers, amplifiers, hard of hearing aids, etc. • Tubes used: 1-6BE6 as R. F. Oscillator, mixer and amplifier. 1-6BE6 as Audio Oscillator. 1-6H6 as Power Rectifier. • Attenuator: A 5 step ladder type of attenuator is used, and each of the 5 steps is continuously variable.



Model 660-A comes complete with coaxial cable test leads and \$42⁹⁵
instructions.

Model
640

ELECTRONIC ANALYZER

Provides all the measuring services required for maintenance, development, testing and repairs of all electrical equipment.

Features:

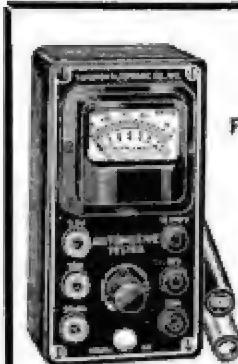
• Will measure actual current consumption while unit under test is in operation and without breaking any connections

• Measures currents up to 75 amperes.



Model 640 comes in hand-rubbed oak cabinet complete with all accessories and \$48⁷⁵
instructions.

A.C. VOLTAGES: 0-15 Volts, 0-150 Volts, 0-750 Volts. D. C. VOLTAGES: (SAME AS A.C.) RESISTANCE: 0-1,000 ohms, 0-10,000 ohms. CURRENT: 0-7.5 amps., 0-15 amps., 0-75 amperes.



Model 60 AUTOMOTIVE TESTER

FOR REPAIRING AUTOMOBILES—TRUCKS

Designed to test the complete electrical systems of automobiles, trucks, buses and boats. The ranges were selected to give maximum service on both 6 and 12 volt battery systems. The Model 60 Automotive Tester will test storage batteries, under load — ALSO Generators, Directional Signals, Oil, Gasoline and Temperature Gauges, Field Coils, Circuit Breakers, Fuses, Cut-Outs, Magnatos, Distributors, Horns, Relays, Armatures, Vibrators, Cigarette Lighters, Solenoids used in overdrive systems, Ignition Coils, Lamps, Regulators, Brushes, Condensers, Ciocis, Electric Heating Systems, Spark and glow plugs, etc.

\$13⁹⁰

Model 60 comes complete with all test leads and instructions. Only..

SOLD ON EASY PAYMENTS AT THE NET CASH PRICE

NO INTEREST OR CARRYING CHARGES ADDED!

Here is your opportunity to buy test equipment on easy payments at the net cash price. If not completely satisfied after trying for 10 days, return to us, no explanation necessary. We will refund down-payment.

MOSS ELECTRONIC DISTRIBUTING CO., INC.

Dept. B-69, 38 Murray Street, New York 7, N. Y.

Please send the units checked. I am enclosing down payment with order and agree to pay the monthly balance as shown. It is understood that there will be no carrying, interest or any other charges provided I send my monthly payments when due. It is further understood that should I fail to make payment when due the full unpaid balance shall become immediately due and payable.

Model 670-A SUPER-METER
Total Price \$28.40. \$7.40 down payment. Balance \$3.50 monthly for 6 months.

Model TV-11 TUBE TESTER
Total Price \$47.50. \$11.50 down payment. Balance \$6.00 monthly for 6 months.

TV BAR GENERATOR
Total Price \$39.95. \$9.95 down payment. Balance \$5.00 monthly for 6 months.

I enclose \$.....as down payment.

Signature

Name

Address

City

Model 660-A SIGNAL GENERATOR
Total Price \$42.95. \$12.95 down payment. Balance \$6.00 monthly for 6 months.

Model 60 AUTOMOTIVE TESTER
Total Price \$13.90. \$3.90 down payment. Balance \$2.00 monthly for 5 months.

Model 640 ELECTRONIC ANALYZER
Total Price \$48.75. \$8.75 down payment. Balance \$8.00 monthly for 5 months.

Zone..... State.....

NOW—top quality Porter-Cable $\frac{1}{4}$ " DRILL in two handy kits



Model 113
HOME KIT
\$38.95

Famous Porter-Cable quality built into this $\frac{1}{4}$ " Drill . . . Jacobs gear-type Chuck—dual-thrust spindle ball bearing—compound reduction gears—full-hand pistol grip. *Home Kit* includes drill, steel carrying case, abrasive discs, drills, lambswool bonnet. Everything you need for drilling, sanding, polishing, around the house.



Model 114
SHOP KIT
\$47.95

Mechanizes hundreds of tedious, time-consuming jobs. Now do wire brushing, sharpening, buffing, drilling and deburring in a fraction of the time. *Shop Kit* includes drill, horizontal drill stand, wire brush, buffing and grinding wheels, rouge, 13 Hi-Speed Drills, steel carrying case.

NEW DRILL STAND

Permits you to apply steady, powerful pressure—with complete accuracy. Drill installed in seconds. Adjustable for height and swing. Drilled base for permanent mounting.

See Porter-Cable Drill Kits and Vertical Drill Stand at your Porter-Cable dealer. Or mail coupon for complete facts.



Model 5009
\$17.75

Porter-Cable

Quality Electric Tools

PORTER-CABLE Machine Co.

(In Canada, send to: Strongridge, Ltd., London, Ont.)

1448 N. Salina Street, Syracuse 8, New York

Please send full information on your $\frac{1}{4}$ " Drill, Kits and Drill Stand . . . also name of nearest dealer.

Name

Address

City County State

Manufacturers of SPEEDMATIC and GUILD Electric Tools

Will the New Submarines Rule the Seas?

(Continued from page 78)

tankers for submergence. Pressures on the tanks would be about the same inside and out, so relatively thin walls could be used.

Today the Submarine Force has changed one submarine into an underwater tanker for study purposes. We are experimenting with other types of craft as well. We have the "K" boats, killer submarines whose job is to lie in wait for enemy submarines and to sink them without warning. We have radar-picket submarines for surveillance of areas in which we want information on ship and aircraft traffic. We have personnel carriers with landing craft that are housed on deck, for making small-scale amphibious landings on hostile shores. We have experimented with guided missiles fired from the deck of a submarine lying on the surface, and there has been talk of water-to-air missiles that would be fired from below the surface and would "home" on a target after emerging into the air.

One of the most valuable uses to which our submarines are being put is their employment as targets for the Navy's anti-submarine-warfare research. We are no longer self-sufficient. We have become an island, so to speak, and must maintain long supply lines of merchant shipping.

These surface craft are vulnerable to the submarines of any potential enemy and that is why great emphasis is being placed on antisubmarine-warfare operations. Our antisubmarine program in the last war wasn't planned ahead of time, so we had to develop it on an emergency basis. This cost a tremendous amount of money and diverted a high percentage of our entire national-defense effort. For a time we were simply trying to build surface ships faster than the enemy could sink them.

To avoid this in the future, antisubmarine-warfare specialists are developing new ways of locating and destroying enemy undersea vessels. Now it is relatively easy to find and, in theory, destroy the best submarines of 10 years ago. But our newest submarines are not so easy to combat.

We would be in serious trouble if an enemy developed a radically new submarine that we couldn't kill. Constant improvement of our own submarines, in turn permitting the testing of more effective anti-submarine-warfare measures, is the only sure way of protecting our surface fleets in the future.

★ ★ ★

The opinions expressed in this article are those of the author and are not to be construed as official, or reflecting the views of the Navy Department or the naval service at large.

Restore Full-Power to your Ford



Insist on Genuine Ford Distributor Points. The contacts are made of pure tungsten . . . to exact Ford tolerances. They help give your Ford new-car power.



Mighty small, aren't they? Yet if these tiny Distributor Points are worn or faulty, your engine may misfire or not run at all. You see, they help build up the spark that sets fire to the gas in your engine. Every mile you travel, they make contact 12,000 times—around 120 million times in an average year's driving!



Pure tungsten is about the only metal that can stand up under this wear and tear . . . and also conduct the high voltage (15,000 volts) necessary to operate your Ford's ignition system. And you can be *sure* that you're getting *pure tungsten* points when you ask for Genuine Ford Distributor Points.

**KEEP YOUR FORD
ALL FORD!**

Available at all Ford Dealers
and selected independent garages
where you see this sign.



You can be sure, too that *all* Genuine Ford ignition parts are made right to work right to last longer in your Ford. They're designed to work *together*. And they're track tested and proved by Ford engineers to make *sure* they're right *before* being approved for manufacture.

VISIT ANY OF THE NATION'S

Historic Shrines

ON A **GREYHOUND** EXPENSE-PAID TOUR

with hotels, transportation, sightseeing,
all included at one low price!

WASHINGTON—4 days sightseeing at Nation's Capital; 3 nights' hotel. **\$24⁵⁰**

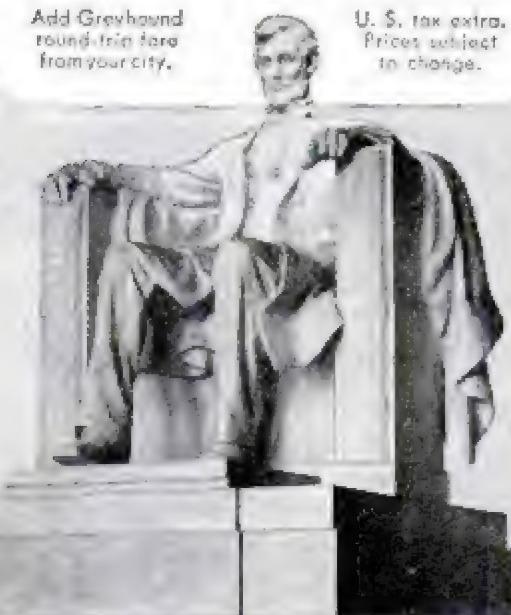
BOSTON—3 days at spots like Lexington, Concord; 2 nights' hotel. **\$15²⁵**

WILLIAMSBURG—2 days at this restored Virginia town; one night hotel. **\$12⁴⁵**

Hundreds of other Greyhound Expense-Paid Tours are available to all America.

Add Greyhound round-trip fare from your city.

U. S. tax extra.
Prices subject to change.



NEW! AIR SUSPENSION RIDE! Greyhound's amazing new HIGHWAY TRAVELER eliminates all steel springs, floats bus passengers on cushions of air.



FREE! MAP OF THE U.S.—WITH TOUR DETAILS
Mail to Greyhound Information Center, 71 W. Lake St., Chicago 1, Ill. for free color map.

Name _____

Address _____

City & State _____ PM-8-59

GREYHOUND



Packard has the best driving position of any car, says Clymer. He rates Ultramatic as the best also

Owners Report on the '53 Packard

(Continued from page 106)

was the big complaint with Clipper Deluxe owners. "I can afford to pay for low gas mileage, but I don't like it." Snyder, N. Y., sales executive.

"After a couple of trips on the highway, I traded this car in because of the gas mileage. I was getting only 8 to 9 miles on a gallon."—Pensacola, Fla., secretary.

Next most numerous complaint was engine noise with 12 percent mentioning it.

"More engine noise with the '53 than with the '50."—Gary, Ind., machinist.

Water leakage around doors and windows was also mentioned. "Leaks over the front doors during heavy rain."—Winnetka, Ill., banker.

"Water leaks bad around vent glass on both front doors," from a Portsmouth, Va., boatbuilder.

There were also a number of complaints about rear-end trouble and noise. Here are some sample quotations:

"Have had three differentials."—Corpus Christi, Tex., Clipper Deluxe owner.

"Rear end had to be replaced after 1000 miles. New one too noisy."—De Kalb, Ill., baker.

Clipper Deluxe owners (61 percent of whom rated their cars excellent) also had these miscellaneous complaints:

"Power brakes need to be made more useful when motor is stopped."—Cleveland, Tenn., construction superintendent.

"No foam-rubber cushion on back seat."—Jackson, Tenn., office manager.

"When crossing a ditch at an angle, the body creaks and groans as though a corner

(Continued to page 234)

Item #126—Four-way, open center control valve with built in adjustable relief valve. Factory set at 1000 P.S.I., spring loaded neutral position, for use with one double acting cylinder. In neutral position cylinder is locked and pump unloaded. Fully balanced plunger type, smooth, positive, easy operation. Can be used as three or mounted in series of two combinations desired. Has $\frac{1}{2}$ " pipe thread inlet and outlet, $\frac{1}{2}$ " pipe thread cylinder ports. No way manufactured to our specifications. Shipping weight 8 lbs. F.O.B. Chicago. **21.50**

SHOP BY MAIL and SAVE at GROBAN'S



(ITEM #126)

HEAVY DUTY HYDRAULIC and AIR EQUIPMENT

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc.

ALL ITEMS BRAND NEW — UNCONDITIONALLY GUARANTEED

EXTRA HEAVY DUTY DOUBLE ACTION HYDRAULIC CYLINDER

Item #224. $\frac{3}{4}$ " bore, 24" stroke, will lift 8250 lbs. with 1000 P.S.I. line pressure. $\frac{1}{2}$ " pipe thread ports— $\frac{1}{2}$ " stressproof ground, polished and plated—solid steel shaft. Overall length closed 36". $\frac{1}{4}$ " steel wall cylinder barrel, clevis mounting at base and shaft. Features—Tie Rod construction. Honed barrel. Ship. wt. 50 lbs. F.O.B. Chicago. **39.60**

Self-Sealing Hydraulic Hose Coupler
Ideal for use where hydraulic systems are frequently disconnected and changed, as on towed farm implements. Each half has $\frac{1}{2}$ " female pipe thread at ends, length $\frac{1}{2}$ " wide. $\frac{1}{2}$ " width. Shipping weight $1\frac{1}{2}$ lbs. Price F.O.B. Chicago. **4.95**



Ross 4-Way Foot Operated AIR VALVE

BRAND NEW—Item #60—for double-acting pneumatic devices. Fine for operating presses, air vises, air machinery of many types. Heavy duty cast construction. No neutral position. Maintains pressure against the piston when the foot control is in the "Up" position. Threaded for $\frac{1}{2}$ " valve body; $7\frac{1}{2}$ " long x $1\frac{1}{2}$ " width x $7\frac{1}{2}$ " high. Net weight 22 lbs. A \$64.00 value for only. **19.50** (CHICAGO)

NEW AIR FORCE SURPLUS — SHATTERPROOF AIR TANK

ITEM #303—Use for air compressors, surge tanks, CO-2 tanks, liquid containers, floats, buoys. 24" long x $4\frac{1}{2}$ " diameter— $\frac{1}{2}$ " pipe thread port. Ship. wt. 10 lbs. F.O.B. Chicago. **2.50**

2 H.P. ELECTRIC MOTOR

ITEM #315—As used in wheelchair described in Popular Mechanics. May be run on 12, 24, or 32 volt circuits. Rated 2 H.P.—24 volt—80 amp. 4600 R.P.M.—Mfd. by Emerson Electric and Diehl Electric Co. Ideal for powering fans, blowers, pumps, compressors, etc. on farms, boats, trucks, test equipment, etc. rugged, powerful. Dimensions: $11\frac{1}{2}'' \times 5\frac{1}{2}'' \times 5\frac{1}{2}''$. Weight 21 lbs. F.O.B. Chicago. **13.00**

CENTRIFUGAL PUMP

General Motors — Allison 200 GALLONS PER MINUTE

Brand New
For Draining Basements
Fire Fighting * Irrigation
Fuel Transfer
Swimming Pools
Home Water Systems
Dewatering

For high volume commercial, home and industrial use. Standard $2\frac{1}{2}$ " pipe thread inlet, twin $1\frac{1}{4}$ " pipe thread outlets. Ball bearing supported $\frac{3}{4}$ " shaft. Easy priming. Rotation, counter-clockwise facing shaft. Gov't. acq. cost \$145.00. Complete with full instructions. Ship. wt. 35 lbs. F.O.B. Chicago. **39.50**

| Suction Lift | Head Pressure | Gal. Per Min. | H.P. | R.P.M. |
|--------------|---------------|---------------|------|--------|
| 10' | 75' | 260 | 6.0 | 3500 |
| 10' | 65' | 260 | 5.2 | 3500 |
| 10' | 80' | 40 | 1.5 | 2500 |
| 10' | 50' | 140 | 5.0 | 3500 |
| 10' | 30' | 160 | 3.0 | 2500 |

ITEM #130



Make Your Own!

The Only Tool
You Need
Is A Screwdriver!
DOOR CANOPY—SPECIAL
47½" WIDE
18" DROP
GRADUATED SIDES
43" PROJECTION
\$21.50—F.O.B. ST. LOUIS

ASSEMBLE AMERICA'S
Most Beautiful
ALL-ALUMINUM
DOOR CANOPIES
AND WINDOW
AWNINGS

They're pretreated, ready for paint. It's easy! Just do the top — the sides are assembled.

Designed and engineered by Herbert's — with experience and machinery to sell you a better owning.

**Also Available Completely Assembled
With Baked Enamel Finish!**

WRITE FOR FREE MEASURING CHART AND LITERATURE



DIRECT FROM FACTORY

Save 50%

8974 St. Charles Rd. *Herbert's*, St. Louis 14, Mo.
Automobile Awning

NEW *Atlas*
GRINDER-HONE



Slickest Tool You've Ever Seen!

This unique new combination grinder and hone enables you to put a perfect edge on almost any tool or implement — from knives, scissors, hatchets, garden tools to plane blades, chisels, drills. Add a wire brush or buffing wheel and you're set to clean and polish a host of equipment.

The 6" grinding wheel turns 3000 RPM, the 5" oilstone hone (with 120 and 320 grits) turns 110 RPM. Tool is ruggedly built — grey-iron base, sealed-for-life ball bearings and Oilite bearings. Weighs 22 lbs. Operates from $\frac{1}{2}$ to $\frac{1}{3}$ HP, 1725 RPM motor. See your *Atlas* dealer, or write for literature. Price F.O.B. Kalamazoo \$31.50.

ATLAS PRESS COMPANY
824 N. PITCHER ST. KALAMAZOO, MICHIGAN

DEPENDABLE QUALITY TOOLS SINCE 1911

post would snap," wrote a Beaumont, Tex., salesman.

"Too much noise from front-end assembly." — Tyler, Tex., insurance man.

Comments About Other Models

Even in the high-price lines, such as the *Patrician*, gas economy was the most frequent complaint. This seems to be a favorite gripe of all American car owners regardless of price class.

Poor acceleration was also mentioned frequently with 13 percent of the owners of higher-price lines listing it.

"Wish motor had a little more snap and faster getaway." — Lewiston, Idaho, *Patrician* owner.

"Not enough snap for 180-horsepower motor." — Tulsa, Okla., editorial assistant.

Miscellaneous complaints included the following:

"Heating and defrosting systems are very, very poor. Locks on doors and trunk too hard to use." — Batavia, Ill., sales manager.

"They seem to forget about us fellows out in the West. We need more road clearance than the big-city guys." — Idaho Falls, Idaho, bakery manager.

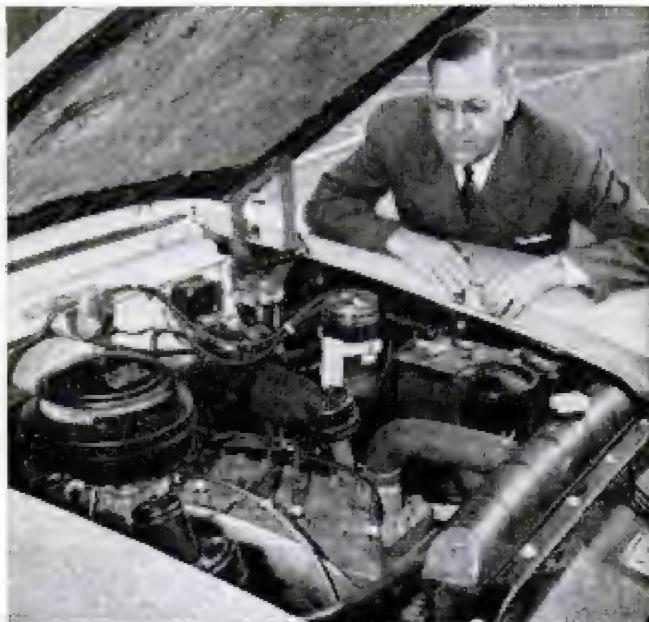
"The factory should complete its job of tightening up the nuts and bolts to eliminate squeaks." — Medford, Ore., *Patrician* owner stated.

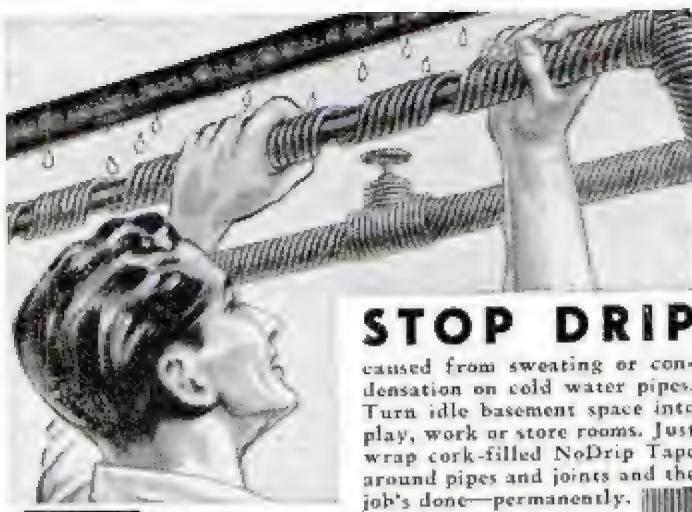
"My usual speed on the road is 75 to 80 and I like my car very much, but wish they would do something about the front end jumping at high speed." — Harvard, Ill., milk dealer.

Power steering and power braking are very much in the news these days and especially with *Packard*. Just about all the

(Continued to page 236)

Packard is one of few now using an inline-8 engine. Horsepower is from 150 to 180 depending on model





STOP DRIP

caused from sweating or condensation on cold water pipes. Turn idle basement space into play, work or store rooms. Just wrap cork-filled NoDrip Tape around pipes and joints and the job's done—permanently.

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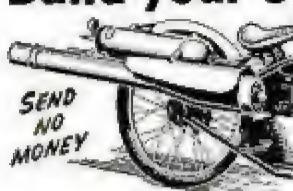
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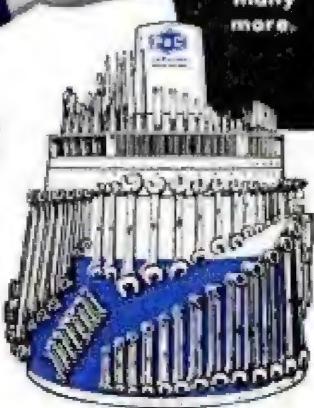
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One Man Operation
Anything you need level
Levelall does it.
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Deluxe
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SMOOTH-ON
THE IRON CEMENT OF MANY USES



owners replying found Packard's Easamatic power brakes worth-while. In fact, 97 percent said they were good.

But on power steering there is disagreement. Only 53 percent of those owners who have tried it say it is worth the extra cost. Here are some quotations on the subject:

"Packard steering without power is easy and accurate."—Knoxville, Tenn., physicist.

"If power steering could be locked out at high speed, it would be fine."—Valparaiso, Ind., salesman.

"Packard has the best power steering. It gives road feel at all times and no fatigue."—El Paso, Tex., salesman.

"Rough roads and running off shoulders do not affect the steering."—Wilmington, N. C., welder.

"I would rather have power steering than automatic transmission."—Norfolk, Va., salesman.

"Even without power, Packard steering is no work. It is unnecessary."—Kansas City, Kans., auditor.

On the matter of the straight-8 versus the V8 engine, 45 percent of the owners preferred the straight as found in Packard. Only 28 percent would like to see Packard go to the V-engine. The others had no opinion.

Owners were asked specifically to rate their Packards on roadability, handling and structural rigidity.

Roadability is the car's ability to hold its course on any type of road at all speeds. Packard rated high in the survey. Only a tiny percentage of owners failed to rate their cars either excellent or good. (See percentage chart for details.)

Here is a typical quote:

"There is no tired feeling after a long trip and the car holds the road just wonderful."—St. Clair, Mich., ship captain.

Handling is the over-all behavior of the car in response to the steering wheel. Packard also rated high in this department as the percentage chart shows.

"One of the easiest handling cars I have ever driven. It is easier to park parallel than the smaller cars I owned. Visibility forward and rear is also the best . . . all four fenders are visible from the driver's seat."—New Albany, Ind., salesman.

Structural rigidity is the car's ability to travel rough roads without unwanted shake or movement of its parts (hood, doors, fenders, etc.). Packard did not rate so highly in this category, especially in Clipper and Clipper Deluxe models. Almost 10 percent of owners rated them as unsatisfactory.

"Doors shake slightly on rough roads."—Stratford, Conn., retailer.

"Hood and doors shake on rough roads."

(Continued to page 238)

More Local Plants Needed to Make Cement Drain Tile

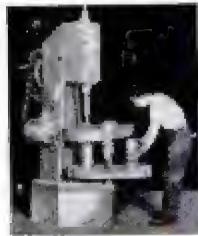
Hundreds of local plants are selling millions of dollars' worth of cement drain tile every year. But demand is getting bigger, and opportunities are open for hundreds more.

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less because local production saves freight and distribution cost. But project possibilities are high. Business requires no previous experience—no skilled labor—no special building. Equipment available on easy terms. Full information on the cement tile business and equipment are given in the Drain Tile Book—free on request.

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KUEMPEL CHIME CLOCK CO., #7 Kuempel Bldg., Minneapolis 16, Minn.

DRAINS Cellars, Laundry Tubs; CIRCULATES Oil; IRRIGATES Gardens

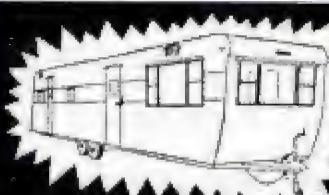
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FOR THE TRIP OF A LIFETIME

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Make your own Jig saw. Complete plans and 6 project patterns included FREE.

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Here is a genuine craftsman's tool with dozens of household and workshop uses. It is perfect for all sorts of coping and jig saw work, making window valances, knickknacks, hobby projects, etc. High-speed, reciprocating-type motor easily cuts asphalt and rubber tile, also masonite and formica—wood, up to $\frac{3}{4}$ ". Perfectly safe for children—so easy to handle that women love to use it. Has only two moving parts, never needs oiling. A high quality tool used by craftsmen, tile layers, and carpenters.



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Oklahoma City, Okla., wholesale druggist.

Now for my own test: I tested the Clipper Deluxe four-door sedan, one of the two lower-price models in the 1953 Packard line. The 327-cubic-inch, 160-horsepower engine is a straight 8 with 8.0:1 compression ratio. Bore is 3½ inches, stroke is 4¼ inches. Basically the same engine is used in all Packards. The Clipper has a 3¾-inch stroke and 7.7:1 compression ratio. All others have the same stroke and compression as the Clipper Deluxe I tested.

I drove this car through city and highway traffic from Los Angeles to San Diego, Calif., and back; over the mountains to Lake Arrowhead (above altitudes of 4000 feet) and through the heat of the Mojave Desert for a total of 704 miles. The car has excellent roadability. I found the 122-inch-wheelbase Clipper easy to handle on the sharp mountain curves. Excellent sea-leg rear shock absorbers add to stability.

Engine power is average for a car of the Clipper's weight. I wouldn't call the acceleration up to 50 miles per hour dynamic, but above 50 it is good. The long-stroke engine gives good "lugging" power at slow speeds. Top speed is excellent—105 to 107 miles per hour by speedometer which was fast by about seven percent. The engine is free of vibration, although there is some steering-wheel vibration in the 70-mile-per-hour range.

I found considerable pinging with regular gas. For best performance premium gas should be used, due to above-average compression ratio. (Of the owners answering our poll, 92 percent use premium gas.) I averaged 18.1 miles per gallon from Los Angeles to San Diego and back and 16.2 miles per gallon in the mountains (see Economy Table).

Packard's power steering requires 4½ turns of the 17½-inch wheel from lock to lock—which will please almost everyone except the sports-car enthusiast. With power steering, one is inclined to oversteer slightly until he becomes familiar with the light pressure needed to turn the wheel. The Clipper's power steering is a direct-action hydraulic unit with rotor pump and an over-all ratio of 22.5:1 as against 27.8:1 without power steering. Its turn-circle diameter is 41 feet. Turn circle is 43 feet on the Cavalier and Patrician models.

The power brakes are excellent, but there is some fading in hard mountain driving. Almost all of the required braking effort is within about ½-inch travel of the brake pedal. There is little "cushion" in the pedal. Once accustomed to action of power brakes the operation is convenient, but it is so sensitive that drastic stops may result

(Continued to page 240)

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| 1-3/16 | 5/16 | 25/64 | .20 |
| 1-17/64 | 5/16 | 15/16 | .20 |
| 1-3/8 | 3/8 | 37/64 | .25 |
| 1-9/16 | 7/16 | 43/64 | .25 |
| 1-9/16 | 1/2 | 43/64 | .25 |
| 1-21/32 | 3/8 | 25/32 | .25 |
| 1-23/32 | 9/16 | 25/32 | .55 |
| 1-27/32 | 9/16 | 25/32 | .55 |
| 2-3/64 | 1/2 | 25/32 | .60 |
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Dept. PM-8, 140 WEST BROADWAY, NEW YORK 13, N. Y.

at first. With temperature changes the pedal action needed for braking results seems to vary somewhat.

Packard's Ultramatic automatic transmission consists of a torque converter and gears. The drive is through the torque converter, but the unit locks up and the drive becomes positive in high gear at speeds above 15 miles per hour, depending upon the throttle opening. A slight hum is noticeable while accelerating. There is no delay or clashing of gears during the entire range of Ultramatic's operation. If the throttle is held in wide-open position, the shift to high takes place at approximately 70 miles per hour. Downshifting of the gears from high is possible up to 57 miles per hour by quickly depressing the throttle. Then the torque converter automatically takes over. The up and down shifts are both extremely smooth. There is a minimum of creep when standing with the engine running and with the shift lever in any position. The Ultramatic shift lever is long and extends about two inches beyond the right side of the steering wheel. It is the easiest-operating shift lever on any automatic transmission and it goes into reverse with less effort than most others. In my last Packard test I rated Packard's Ultramatic as the best of all automatic transmissions and I haven't changed my mind about it since.

It is easy to rock the car free in mud and snow by moving the lever quickly from Low to Reverse. The parking-lock feature is good. The indicator is illuminated and easy to read day or night. Water from the low end of the radiator cools the oil of the Ultramatic unit regardless of load, traffic conditions or climate.

The Briggs-built body is solid and well-built. It is dust and water proof and I found no leaks in my test in the dusty desert or through rain in the mountains. There is adequate headroom in Packard bodies. I noticed very little body rumble or wind noise even at high speeds.

The interior finish is above average and the seat cushions have excellent springing and upholstery. The doors open easily by push button.

The parking brake operates with the left hand. Release is by twisting and could be easier. The ignition key is operated by the left hand. As more drivers are right-handed, I'm sure they would prefer the ignition switch and parking-brake lever located at the right instead of the left side of the steering column.

The windshield wipers are operated by a knob located in an unusual position on the side of the steering column, a very convenient location.

(Continued to page 242)

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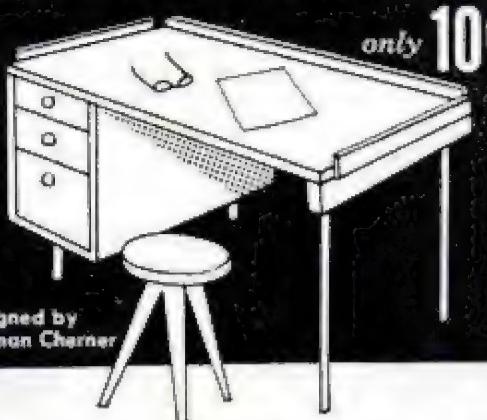
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Designed by
Norman Cherner

START Friday night, finish Sunday. This clean-lined modern desk is a snap to build with Douglas fir plywood. Plywood is easy to work with ordinary tools. Takes any finish. Won't split, chip or crack. Get desk-chest plans from your lumber dealer or send 10c to Douglas Fir Plywood Association, Tacoma 2, Washington.

Douglas Fir
Plywood

Lumber dealers now have new small-size Handy Panel in self-service racks. Easy-to-use Handy Panels are quality-tested, trademarked Douglas fir plywood.



There is one ash tray in the rear and two in front, one of these being on the extreme right for the front-seat passenger. The glove compartment is average size and of the pull-out drawer type, which many will like better than a hinged door.

The brake pedal is convenient for use by the left foot, a technique which all drivers of automatic-transmission cars should learn to use. Controlling the throttle with the right foot and braking with the left foot enable much faster operation of the two pedals in emergencies as well as in controlling the car in mountains or winding roads. The starter is operated by depressing the throttle pedal. Personally, I don't care for it.

The massive bumpers offer good protection front and rear. The large luggage compartment has a counterbalanced lid that is easy to open and close. I am glad to see that last year's very bad locking arrangement (which I criticized) has been drastically changed for the better. I now rate the trunk-locking arrangement above average.

The curved one-piece windshield has exceptional glass area for good vision. Even though the engine is a long straight-8, vision directly in front of the sloping hood is good, and that's a safety feature. The position of the rear-view mirror at times obstructs forward vision, but due to the position of the rear window, I don't know how it can be avoided unless by use of an outside mirror, which isn't good for rear vision on the right side of the car.

The top of the instrument panel is plain and there is little sun reflection from chrome to bother the driver.

As is true of all cars, there are some things I do not like about the Packard, but I want especially to comment on the position of the driver, the angle and position of the steering wheel, and the entire layout of the instruments. I think Packard has the most comfortable driving position and best arrangement of instruments of any car I've driven. I say this not only because of the convenient location of the instruments, but because Packard's steering-wheel position permits relaxed driving. There is no horn-ring obstruction of any instrument or gauge above the upper half of the steering wheel.

Packard definitely is on the comeback trail toward strengthening its prestige position. With its new models, owner satisfaction is higher than at any time in the firm's long history. If you are a quality-car prospect it will pay you to look over the new Packard line.

★ ★ ★

There are more private airplanes registered in California and Texas alone today than existed in the United States prior to the outbreak of World War II.

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It's a power sickle
It's a cultivator

NO PUSHING
Tractor shown with 20" Rotary Mower Attachment (Item 206) famous
Rotary Tiller
Power Sickle, etc.
Basic self-propelled 2 hp. tractor. Briggs or Clinton engines.

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No other coverall can match the trim, tailored effect, the silky sheen, or the long wearing quality of this newly developed coverall. Fully-piped doublet zippered-off and on in a flash. Beautifully made of extra strong, lightweight, frost-free Green Nylon—provides cool comfort in hot weather and extra warmth in raw winds over other clothing. 8 spacious pockets—a place for everything. Folds to compact size for carrying anywhere. Unlimited uses for gardeners, pilots, mechanics, servicemen, engineers, motorcyclists, farmers, etc. Small, med., large. Item 48) Reg. \$30. Special



\$12.95

44 Pcs. SOCKET SET



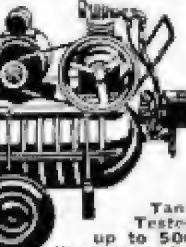
thru 1-1/16" in 1/2" drive, reversible 1/2" ratchet, "L" handle, side head, all angle coupling, 1/2" speeder handle and a BIG doghouse tool box with ample room for other tools plus 5 pc. hi-tension alloy combination wrench set and 7 pc. offset wrench set. Easily worth \$40.00.

52 Pcs. SOCKET SET

(Item 205) Contains a complete set of sockets in 1/2" drive, 3/8" drive and 1/4" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc. All socket guaranteed against breakage. Beautifully matched chromed thin wall alloy sockets in a sturdy handsome steel tool box. Wt. 17 lbs. List Price \$62.50. Factory Special

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Item 200. High pressure type for large volume of air for heavy duty service. For paint spraying, inflating tires and auto tires, glycerine and the hundreds of other jobs done by compressed air. Piston type. Master built with high strength alloys and precision bearings. Stainless steel tank, 12" x 24", 2100 cu. in. cap. Sane up to 300 lbs. Equipped with automatic switch that starts and stops motor to maintain desired pressure up to 150 lbs. and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Low factory price. Wt. 14 lbs. 110 v. A.C. motor. Reg. \$175.00. Item 200. With 1/2 hp. motor, Reg. \$190.50. With 2 hp. Briggs Gas Engine, Reg. \$190.50 (Item 200A).



up to 500 lbs. per sq. in.
99.50
\$119.50
\$109.50

MASTER SHOP COMPRESSOR

Big and rugged. This stationary compressor provides 8 c.f.m.—plenty of air for industrial uses, powered by heavy duty repulsion induction 3/4 HP, 115/230 v. motor. Factory type twin cylinder compressor designed for continuous operation. Mounted on heavy 20 gal. steel tank. Complete with unloader type automatic switch, pressure relief valve, check valve, gauge, shut-off valve, and 20 ft. heavy duty air hose. Item 200B. Regular retail \$319.50. Factory price



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FACTORY DISCOUNTS up to 85%



HEATING & VENTILATING FAN

Item 100 easily installed in furnace pipes. Forces even heat to all rooms. Over range reduces kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. United, super-efficient fan moves huge volume of air, 100 to 1200 CFM; 8" Fan, wt. 8 lbs. \$6.75; 10" Fan, wt. 8 lbs. \$7.85; 10" Fan, wt. 7 lbs. \$8.95; 12" Fan, wt. 8 lbs. \$9.85. **HEAVY DUTY FAN**. Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc. 10" Fan, wt. 8 lbs. (Item 10E).....\$11.95
12" Fan, wt. 10 lbs. (Item 10D).....\$12.95

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The ideal stove for summer cottages, camps, trailers, terraces, and patios. Two burners, each having three heats, provide 3000-5000 BTU watts and fast heat. Heats water in no time at all for washing, shaving, cooking, etc. Has positive acting, heatproof rotary switches. Underwriters approved cord; ruggedly made—will last for years. Finished in easy-clean white baked enamel. These ranges were built to sell for \$28.95. Only a terrific factory close-out makes this price possible. Limit two to a customer. Wt. 10 lbs. Item C207.....\$8.95

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Heavy duty, made of Buna insulated #14-2 conductor stranded wire encased in a treated tinned jacket moderately flexible and ideal where frequent coiling is not required. Resists oil, grease of water. Use indoors or out. Complete with heavy rubber plug and outlet. Item 106
10 ft. 210 lbs.1-20 ft. total 100 ft.106\$1.99
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#10, 2 conductor stranded wire, extremely flexible. Ideal for hedge trimmers, lawn mowers, power tools, etc. Insulated and rugged, with staples and closure. Complete with rubber plug and outlet. 40 ft. (Item 160) wt. 10 lbs. Regularly \$4.05. \$2.45
100 ft. (Item 161)\$2.45
100 ft. length 11 pieces....Item 160\$5.95
Wire only. No fittings....Item 161\$5.00
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Bolt-in air-cooling system. ARC is easy to strike and hold, because of specially designed arc stabilizer. Hi-line switch and dial control gives wide range of welding heats. Run welder at 2000 rpm. with tractor, jeep or 15 hp. gas engine or 7 hp. electric motor. Complete with instructions, gauge and triple V belt or flat pulley. You can pay more, but you can't buy a better

welder. Wt. 110 lbs. \$400 value at \$99.75
DUAL CONTROL MODEL same as above but with built-in dual rheostat for low heat

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WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at

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PORTABLE LIGHT PLANTS

350 Watt Plant (Item 279) 115 v. DC, 1 1/2 hp. Briggs Engine. Perfect for lights, radios and small power tools, etc. Wt. 65 lbs. Factory price

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AC Plant 400-500 Watts—115 v.-60 cyc. Powered by a rugged 2 hp. easy-starting Briggs gas engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 w. Ideal for Civil Defense, Fire Dept., trailers and camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Item 24. Wt. 75 lbs. Be prepared if war or storms knock out power lines. Reg. \$175.00 value.

\$143.50

700-800 Watt Plant (Item 44) same as above but larger engine. Reg. \$210.00 value.

\$169.95

1000-1200 Watt Plant (Item 45) same as Item 24 but with larger generator and engine—gives greater output.

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1500-1700 Watt Plant (Item 201) Similar to Item 24, but has three times more capacity. Wt. 175 lbs. Factory price

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MASTER-LITE 2500 Watt PLANT

110-120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button start.

\$329.50

Built-in winding to charge battery. Powered by a big 5.0 hp. Briggs engine. Complete with all accessories. Includes control box, voltmeter and handy plug-in power receptacle. Ideal for permanent or standby service. Wt. 225 lbs. Regular price \$415.00. Factory price

\$329.50

3500 Watt Plant Push Button Start (Item 211) 115 v. 60 cyc. AC. Similar to above, but larger and gives more capacity. Wt. 270 lbs. Reg. \$700. Factory price

\$379.50

Giant 2000-2500 Watt Plant—110/120 v. AC, belt driven so that engine may easily be utilized for other purposes. Powered by a rope start. 6 1/2 hp. engine. Wt. 230 lbs. Regular list price \$685.00.

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Generator only and control box (Item 212) \$169.50
3000-3500 Watt Plant (Item 198) 110-220 v. AC. Belt driven with Wiss engine. Push button start. Wt. 310 lbs. Heavy duty generator only for belt drive. Wt. 115 lbs. Item 198a

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HI-LINE 6000 WATT PLANT

Item 162 Push Button Start. 115-230 v. 60 cycle AC. A brute of a powerplant with a rugged 12 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 540 lbs. Regularly worth \$195.00, with self starter. Factory Spec.\$645.00

Some plants with Crank Start (Item 160) \$585.00 Generator and control box only, belt driven. Use your own engine or tractor. Wt. 240 lbs. Item 161. Factory price

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We make fully automatic controls to operate any of above light plants. Write for details. (Item 162)

DIESEL LIGHT PLANT

Running 1000 ft. Diesel Master—11-12 kw. 115/230 v. AC single or 3 phase. 1800 rpm. Direct connected. Designed and engineered for permanent power installations. Ample efficient, dependable, low cost

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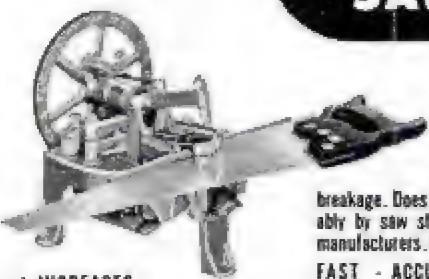
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The Turbojet Truck . . .

Hottest on the Road

(Continued from page 69)

necessarily intend to get into the truck-engine business when it began basic research in January 1944 on gas-turbine engines. Out of this research have come engines now being tested in a Navy personnel boat, a Kaman helicopter and a Cessna XL-19B light airplane as well as the Kenworth truck. All adaptations hold promise, but the truck unit looms bright in the spotlight because of its great contrast with present truck engines.

"You have to think of this engine in two stages," said Hull. "In the first stage, a



Weight of the engine is only 200 pounds, 2500 to 3000 pounds less than that of conventional diesel

centrifugal compressor rotates at a maximum speed of 36,000 revolutions per minute. Sucks air like a vacuum cleaner, then compresses it to three times normal atmospheric pressure and delivers it to the burners. As fuel is fed into the burners, the temperature is raised to a maximum of 1500 degrees Fahrenheit. The hot gas then passes through the first-stage turbine wheel. This wheel extracts sufficient power from the gas stream to drive the compressor which is on the same shaft.

"In the second stage, the gas stream passes through another turbine, which is not on the same shaft as the first-stage turbine wheel. The second-stage or power-turbine wheel operates at 25,000 revolutions per minute. This is reduced in an 11:1 reduction gear to drive the truck. The system is really simple."

Maybe. But about that terrific heat . . .

"It's a major problem, all right," nodded Hull. "Used in the alloy of the turbine blade are cobalt, tungsten, chromium and

(Continued to page 246)

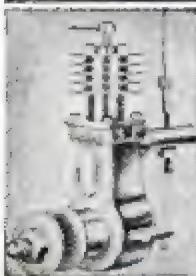


This attachment gives you two drills in one. It converts any $\frac{1}{4}$ inch electric drill to $\frac{1}{2}$ inch capacity. Reduction gears reduce the drill speed 5 to 1, the average speed of a $\frac{1}{2}$ inch drill, and thereby increases the power. Absolutely indispensable for all shop work and home craftsmen.

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You just can't beat this price for a precision diesel engine! Streamlined, compact, easy to install. Thousands of satisfied users all over the world. Fast delivery if you ORDER TODAY! Send \$3.95 plus 25c postage.

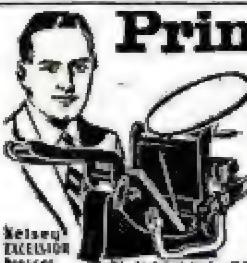
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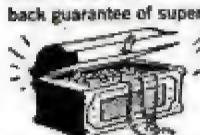
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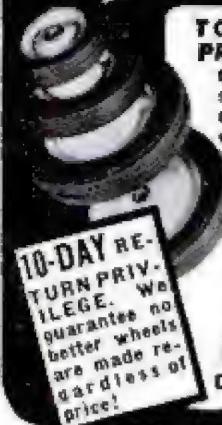
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| 8x1.75 | 80 lbs. | 1.95 |
| 10x1.75 | 100 lbs. | 2.30 |
| 10x2.00 | 140 lbs. | 2.65 |

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nickel. But the power of the engine is still limited by the ability of the metals to withstand heat. The struggle to find tougher metals is never-ceasing."

Engine changes in the experimental truck have been necessary more frequently than in an ordinary diesel truck.

"But the changes are easy," said Earl Reed, Boeing test engineer. "You can figure about eighteen hours for four men to change an ordinary diesel. Two men can change a gas turbine in four hours."

From the commercial point of view, the biggest drawback at the moment is fuel consumption. On our trip from Seattle to Yakima we got about 1½ miles per gallon of diesel oil. A regular diesel truck would get about 5 miles. But the Boeing engineers are working to reduce the fuel consumption and the engine would burn a cheaper fuel if it were on the market.

Military men are interested in the variety of fuel the engine burns. In combat areas, you can't always get the right fuel at the right place and time. Once, 25 gallons of gasoline were added to the truck's diesel tank and performance was unchanged.

Also intriguing to military men is the light weight of the spare parts as well as the engine. There is no spare part that can't be handled by one man.

As for commercial men, here's the comment of John G. Holmstrom, vice-president and general manager of the Kenworth Motor Truck Corporation:

"If extended tests prove as successful as the preliminary trials, we can see a great future for this lighter and simpler power plant in trucks, tractors and other mobile equipment."

And I. W. Shepherd, general traffic manager at Seattle of the West Coast Fast Freight, Inc.:

"The general public has a big stake in the development of this engine for trucks. If the trucking industry can take advantage of heavier pay loads through it, the public will benefit by lowered shipping rates. Too, the speed of the engine is more constant and there should be less backing up of traffic behind trucks."

All of which brings up that big question, which we asked the Boeing engineers:

When will the Boeing gas-turbine engine be on the market?

The answer: Kinks are still being removed and military commitments are expected to keep all production channeled into various defense projects for some time.

This fact won't make commercial truckers happy, but it should make service-station operators smile with relief. The lubrication-oil capacity on the gas-turbine engine is only four quarts.

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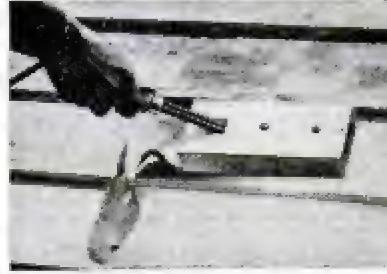
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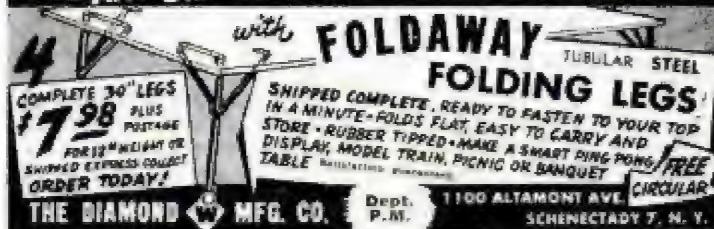


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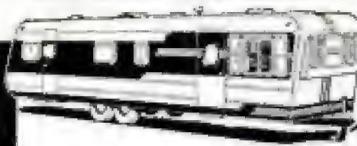
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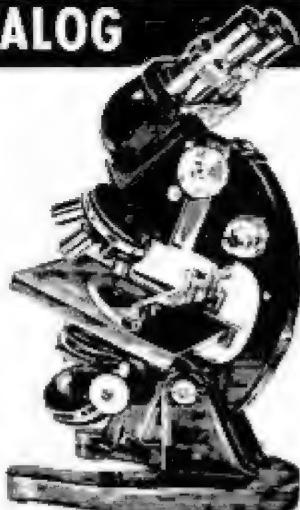
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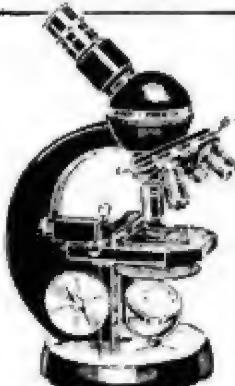
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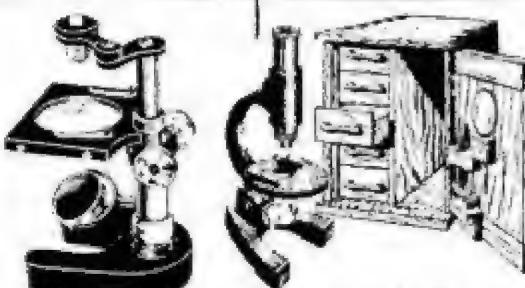
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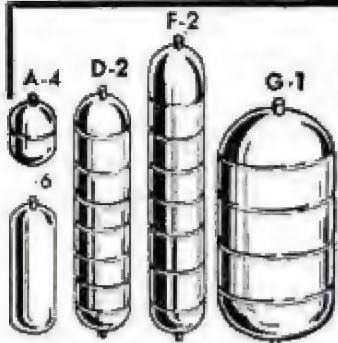
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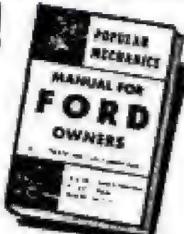
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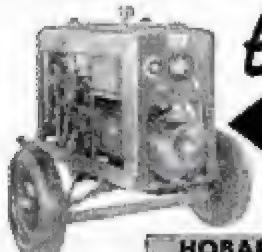


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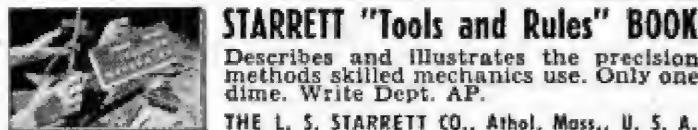
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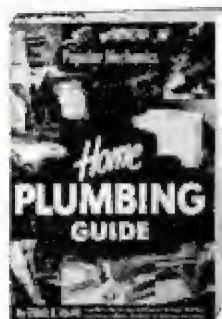
NOWADAYS it's a rare neighborhood that has the services of a jack-of-all-trades. When something goes wrong you either call in a high-priced specialist in the particular trade or do the job yourself. If you're like most of us, the second choice is full of pitfalls. You may or may not fancy yourself as a handyman. But you know from past experience that there are jobs on which you spent twice as much money and three times the hours necessary because of a lack of that precious commodity, "know-how."

A HELPING HAND at such times is the know-how contained in the how-to-do-it books published by Popular Mechanics Press. Many homeowners have found that the time and money saved on one comparatively simple repair job has paid for the cost of the book. And those with a small collection of these specialized books, all characterized by step-by-step instructions and easy-to-follow pictures and diagrams, have saved hundreds of dollars and work hours.

LET'S TAKE A RUNDOWN on some of the books that could be valuable to you. *The Handyman's Guide to Home Repairs* (\$2.50), is a 192-page book, with 648 illustrations, compiled by Popular Mechanics editors. There are chapters on repair and maintenance of doors, windows, floors, roofs, stairs, basements and attics, wiring, heating, insulating, plumbing, painting and remodeling procedures. More detailed treatment of these specific subjects is contained in other books: *Home Plumbing Guide* (\$3.50), by Enno R. Haan; *How to Paint With Brush and Spray* (\$2.50), by Sam Brown; *All About Upholstering* (\$3.50), by John Bergen. Books on home maintenance compiled by Popular Mechanics editors include *What to Make With Concrete* (\$2.00); *Lawn and Garden* (\$2.50), and *Welding, Brazing and Soldering* (\$1.75).

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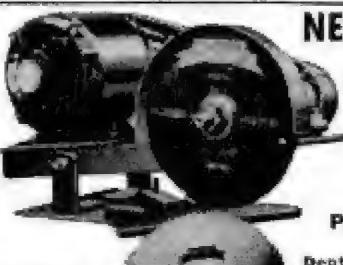
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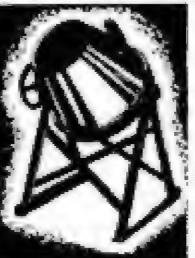
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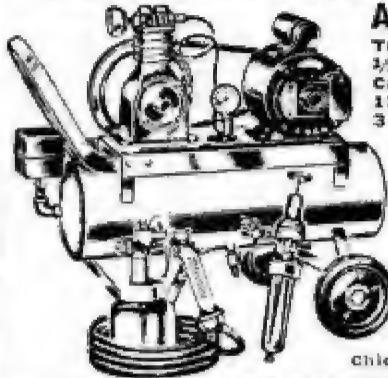
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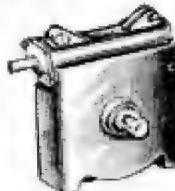
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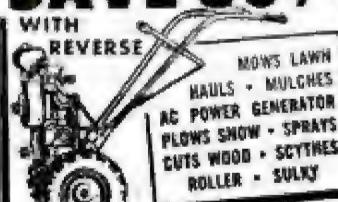
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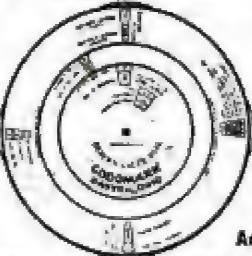
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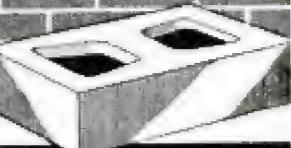
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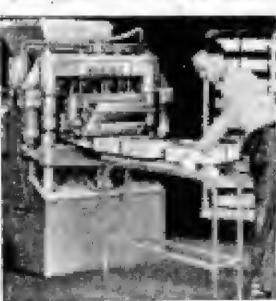
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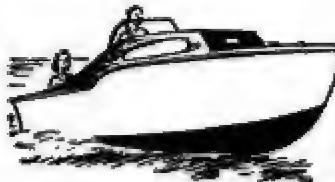
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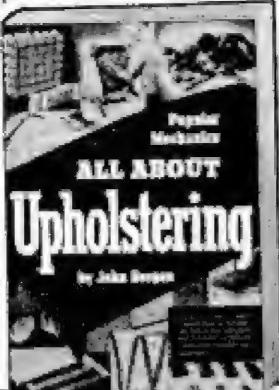
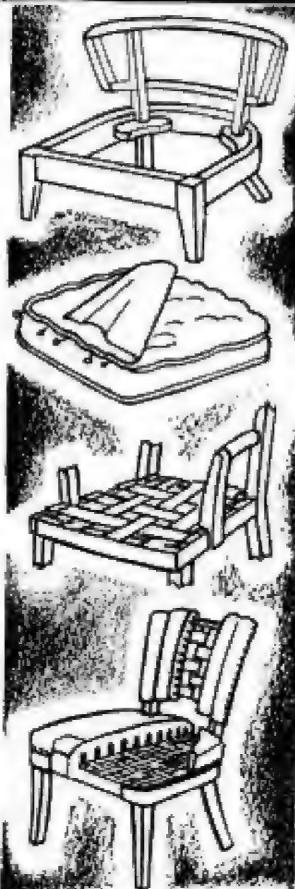
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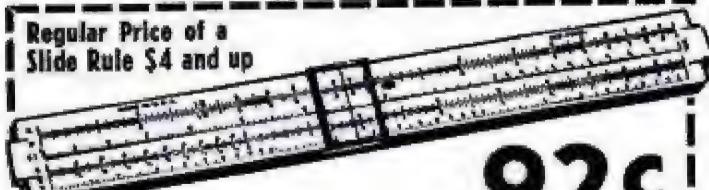


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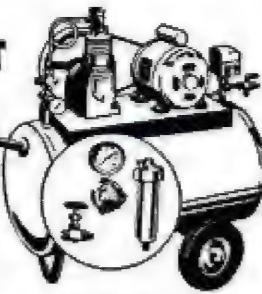
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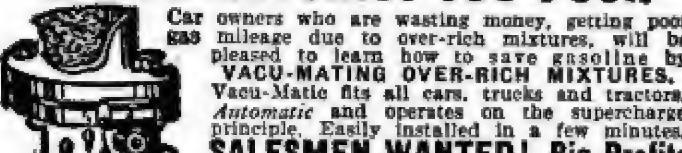
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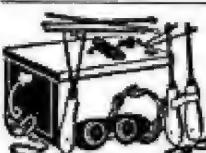
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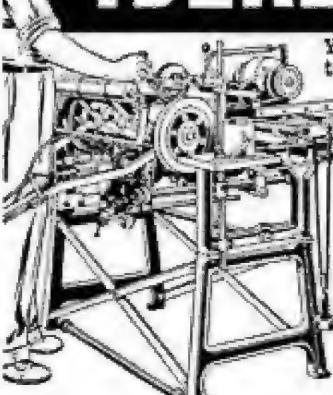
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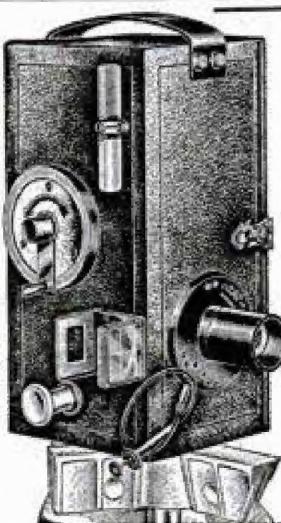
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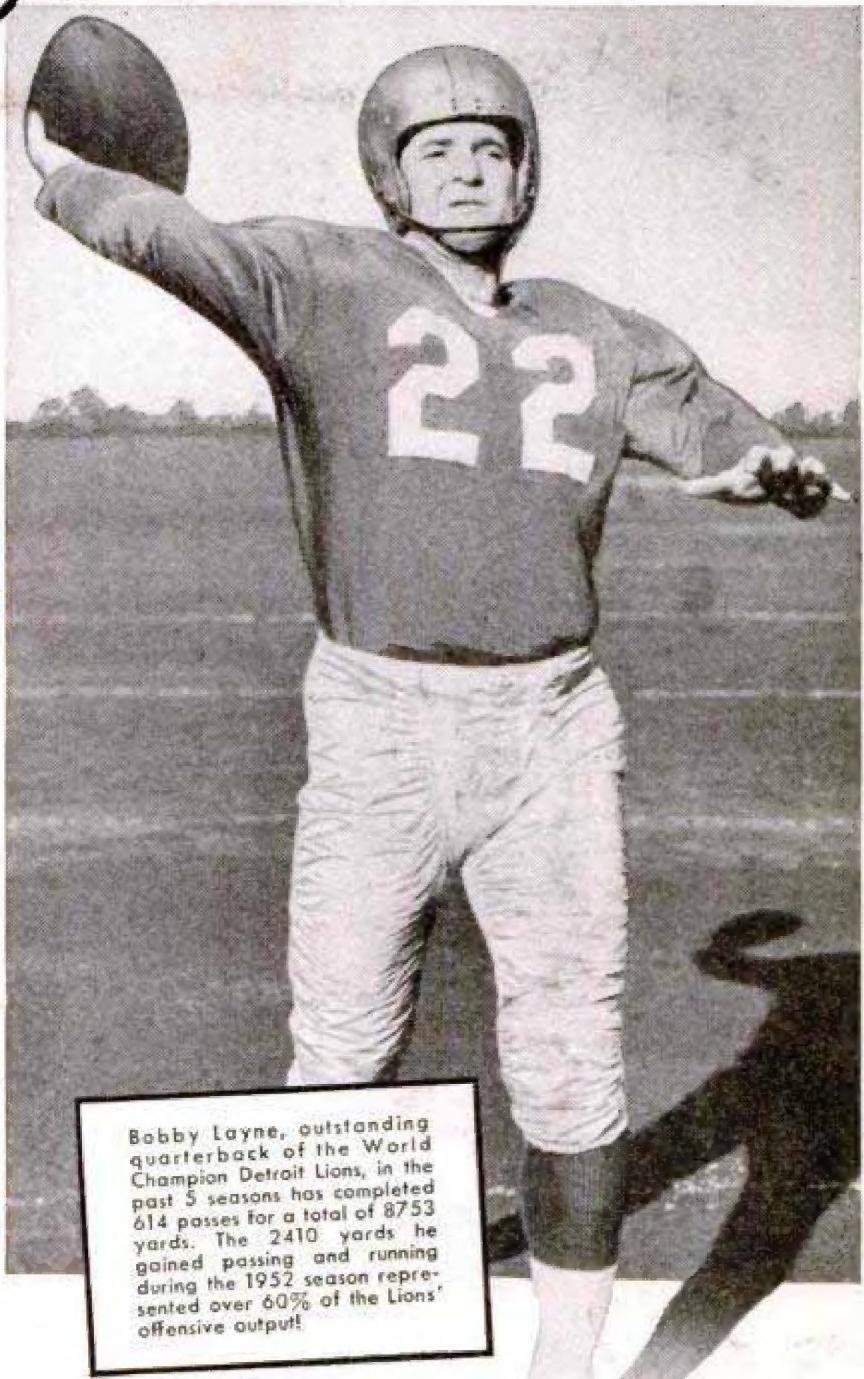
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